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EPA Superfund
Record of Decision:

JOLIET ARMY AMMUNITION PLANT (LOAD-ASSEMBLY-PACKING AREA) and JOLIET ARMY AMMUNITION PLANT (MANUFACTURING AREA)
EPA ID: IL0210090049 and IL7213820460
OU(s) 01, 02 & 01, 02
JOLIET, IL
10/30/1998

Joliet Army Ammunition Plant
Wilmington, Will County, Illinois

Record of Decision for the Soil and Groundwater Operable Units on the Manufacturing and Load-Assemble-Package Areas, National Priority List Sites

October, 1998

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III. COMMUNITY PARTICIPATION RESPONSIVENESS SUMMARY

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List of Acronyms

AEHA	Army Environmental Hygiene Agency
AOP	Ammonia Oxidation Plant
ARAR	Applicable or Relevant and Appropriate Requirement
AST	Above-Ground Storage Tank
BNA	Base-Neutral-Acid, also referred to as semivolatiles
BRA	Baseline Risk Assessment
BTAG	Biological Technical Assistance Group
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CAMU	Corrective Action Management Unit
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
COC	Chemical of Concern
CY	Cubic Yard
CFR	Code of Federal Regulations
CHPPM	Center for Health Promotion and Preventive Medicine
DNAPL	Dense Non-Aqueous Phase Liquid
DNB	Dinitrobenzene
DNT	Dinitrotoluene
DQO	Data Quality Objective
ERA	Ecological Risk Assessment
FFA	Federal Facility Agreement
FOST	Finding of Suitability to Transfer
FS	Feasibility Study
GMZ	Groundwater Management Zone
GOU	Groundwater Operable Unit
GRU	Groundwater Remedial Unit
HI	Hazard Index
HMX	High Melting Explosive
IAC	Illinois Administrative Code
IEPA	Illinois Environmental Protection Agency
IRP	Installation Restoration Program
JOAAP	Joliet Army Ammunition Plant
LAP	Load-Assemble-Package Area
LDR	Land Disposal Restriction
LNAPL	Light Non-Aqueous Phase Liquid
LTTD	Low-Temperature Thermal Desorption
MFG	Manufacturing Area
MG	Million gallons
MW	Monitoring Well
µg/g	Microgram per gram
µg/L	Microgram per Liter
NA	Not Applicable
NB	Nitrobenzene
NC	Chemical is not a Contaminant of Concern

NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NFA	No Further Action
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List
NT	Nitrotoluene
PAH	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PCE	Tetrachlorethene (Perchloroethene)
PH1	Phase I (of the Remedial Investigation)
PH2	Phase 2 (of the Remedial Investigation)
ppm	Part Per Million
PP	Proposed Plan
PRG	Preliminary Remediation Goal
PVC	Polyvinyl Chloride
RAB	Restoration Advisory Board
RAG	Risk Assessment Guidance
RAO	Remedial Action Objective
RBC	Bioreactor Risk-based Concentration
RCRA	Resource Conservation and Recovery Act
RDX	Royal Demolition Explosive
RG	Remediation Goal
RI	Remedial Investigation
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SF	Square foot
SOU	Soil Operable Unit
SRU	Soil Remedial Unit
TBC	To Be Considered
TBE	To be evaluated after the public review period
TCLP	Toxicity Characteristic Leaching Procedure
TNB	Trinitrobenzene
TNT	Trinitrotoluene
TPH	Total Petroleum Hydrocarbons
TSCA	Toxic Substances Control Act
USACE	U.S. Army Corps of Engineers
USAEC	U.S. Army Environmental Center
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
USDA	U.S. Department of Agriculture
USDA/FS	U.S. Department of Agriculture, Forestry Service
USEPA	U.S. Environmental Protection Agency
UST	Underground Storage Tank
UV	UltraViolet
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound
WCLF	Will County Landfill

GLOSSARY

Absorption	Penetration of one substance into the inner structure of another.
Adsorption	A phenomenon where one substance is attracted to and held on the surface of another.
Air Stripping	Process where an air stream is used to remove relatively volatile dissolved organic compounds.
Biodegradation	A molecular degradation, or chemical breakdown, of an organic substance resulting from metabolic action of living organisms (principally bacteria, fungi, algae, or yeast).
Bioreactor	A reactor where combined, attached and suspended biological growth exist to biodegrade an organic substance.
Bioremediation	Process where the biological microorganisms are used to biodegrade the contaminants in soil and groundwater.
Carbon Absorption	Process where contaminants are attracted and held on the surface of activated carbon.
Chemical Dehalogenation	The addition of a chemical reagent to break the chemical structure of PCBs.
Groundwater	Water beneath the earth's surface between saturated soil and rock that supplies wells and springs.
GMZ	Groundwater Management Zone. A three-dimensional region within any class of groundwater. The GMZ contains groundwater being managed to mitigate impairment caused by the release of contaminants from a site.
GOU	Groundwater Operable Unit (GOU). GOUs consist of sites where contaminated groundwater plumes were identified.
Incineration	High temperature process to volatize and/or combust organic constituents in soils.
Low Temperature Thermal Desorption	Process where the low temperature is used to remove organic compounds from the contaminated media for subsequent collection and disposal.
RCRA Hazardous Wastes	Regulations for RCRA hazardous wastes are provided in 40 CFR 260 through 272. Characteristic wastes (shown as Dxxx) exhibit the characteristics of ignitability, corrosivity, reactivity, or toxicity. Listed wastes (shown as Fxxx, Kxxx, Pxxx, or Uxxx) are process wastes that are regulated under 40 CFR. The following characteristic and listed wastes have been identified as potentially existing at JOAAP: D003 Explosives category based on 40 CFR 261.23 (6), (7) or (8) D006 Wastes that exhibit or are expected to exhibit, the characteristic of toxicity for cadmium based on extraction procedure (EP) in SW846 Method 1310. D008 Wastes that exhibit or are expected to exhibit, the characteristic of toxicity for lead based on extraction procedure (EP) in SW846 Method 1310. D030 Wastes that have toxic characteristics (TC) for 2,4-Dinitro-toluene based on the TCLP in SW846 Method 1311 K046 Wastewater treatment sludge from the manufacturing,

	formulation and loading of lead-based initiating compounds K047 Pink/red water from TNT operations. K048 Dissolved air floatation (DAF) float from the petroleum refining industry. K111 product washwaters from the production of dinitrotoluene via the nitration of toluene U220 Toluene as a raw material or commercial chemical product
RCRA Subtitle C landfill	A hazardous waste landfill disposal facility
RCR A Subtitle D landfill	A non-hazardous solid waste landfill disposal facility
Semivolatiles	Carbon-containing compound which does not evaporate readily at ordinary temperatures. Semivolatiles are also known as BNAs (Base-Neutral-Acids)
SOU	Soil Operable Unit (SOU). SOUs consist of sites where contaminated soils, sediments, and debris were identified.
Solidification/ Stabilization	Process where the contaminants are physically or chemically bound and stabilized to reduce mobility. Binding agents for inorganic contamination include cements, lime, pozzolans, gypsum, and silicates. Binding agents for organic contamination include epoxy, polyesters, asphalt, polyolefins and urea-formaldehyde.
Solvent Extraction	Process where solvent is used to remove and concentrate organic compounds
Special Wastes	Special wastes are defined under the Illinois Environmental Protection Act as, "any industrial process waste, pollution control waste or hazardous waste except as determined pursuant to Section 22.9 of this Act. "Special Waste" also means potentially infection medical waste. [Section 3.45]
TCLP	Toxicity Characteristic Leaching Procedure. The laboratory procedure used to determine whether the toxic contaminants of concern leach from the waste at unacceptable levels.
UV Oxidation	Ultra Violet Oxidation. Process where the chemical degradation of contaminants is accomplished by adding a strong oxidizer (e.g. ozone) and passing water by UV lights.
VOC	Volatile Organic Compound. A carbon-containing compound which evaporates readily at ordinary temperatures.
WCLF	Will County Landfill (WCLF) This future proposed landfill will be a permitted special waste landfill (as defined in Section 22.9 of the Illinois Environmental Protection Act) and will also be a permitted RCRA Subtitle D landfill.

<u>DECLARATION FOR THE RECORD OF DECISION</u>

<u>SITE NAME AND LOCATION</u>
Joliet Army Ammunition Plant,
Soil and Groundwater Operable Units
Manufacturing and Load-Assemble-Package Areas
Wilmington, Will County, Illinois

<u>STATEMENT OF BASIS AND PURPOSE</u>
This decision document presents the selected final and interim remedies for the Joliet Army Ammunition Plant (JOAAP), Soil and Groundwater Operable Units (SOU, GOU). These remedies are chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 and the National Contingency Plan (NCP). This decision is based on the administrative record file for this site. The United States Environmental Protection Agency (USEPA) Region V and the Illinois Environmental Protection Agency (IEPA) concur with the selected remedies. This document complies with and satisfies the intent of the National Environmental Policy Act (NEPA) of 1969.

JOAAP has been addressed under the CERCLA program as two National Priority List (NPL) sites, the Manufacturing (MFG) Area and the Load-Assemble-Package (LAP) Area. The MFG and LAP Areas were listed on the NPL on July 21, 1987 and March 31, 1989, respectively. This Record of Decision (ROD) addresses the remediation of soil and groundwater in both the MFG and LAP Areas.

<u>ASSESSMENT OF THE SITE</u>
Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response actions selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment,

<u>INTERIM COMPONENT</u>
Actions described within this document are considered interim related to soil remedial units (SRUs) 1, 2, 3, and 5 as applicable to USDA lands. A subsequent Final ROD is planned to address this interim component. All other decisions within this document are considered final.

<u>DESCRIPTION OF THE SELECTED REMEDIES</u>
The OUs are divided into seven soil remedial units (SRUs), three groundwater remedial units (GRUs), and two No Further Action (NFA) groups. The SOU is divided into six SRUs involving CERCLA-based remediation, one SRU involving non-CERCLA removal action, and an eighth group involving the NFA sites for soil. The soil in this eighth group has been determined to pose no threat to human health or the environment. The GOU is divided into three GRUs involving CERCLA-based actions, and one group including the NFA sites for groundwater. The groundwater in this latter group has been determined to pose no threat to human health or the environment. The goal of the final cleanup of the SRUs and GRUs is to protect human health and the environment by eliminating, reducing, or controlling hazards posed by the site and to meet all applicable or relevant and appropriate requirements associated with the site. The goal of the interim actions is to remove sources of groundwater contamination and/or to prevent the

further migration of contamination. Overall, fifty-three (53) sites and three (3) subareas of these sites were identified in the CERCLA program at JOAAP.

SRU1, Explosives in Soil, addresses an estimated 151,480 cubic yards (CY) of explosives-contaminated soil. The selected remedy for SRU1 is Bioremediation (see Section 9.1.2). The major components of this remedy include the excavation of soils and sediments contaminated with explosives above the Remediation Goals (RGs), confirmatory sampling, and treatment of the soil using a bioremediation process. The treated soil will be reused or properly disposed.

Some of the soils in SRU1 were contaminated by Resource Conservation and Recovery Act (RCRA) listed hazardous wastes, and as such "contain" these wastes. The Army based its detailed analysis of alternatives and selection of remedial technologies for these SRU1 soils on two determinations. First, media, such as soils, at JOAAP that were contaminated with RCRA listed hazardous wastes, are not themselves hazardous wastes unless they exhibit the characteristic for which the waste was listed. Second, once media contaminated with RCRA listed hazardous wastes are treated to below RGs, are not Toxic Characteristic Leaching Procedure (TCLP) hazardous wastes under RCRA, and do not exceed RCRA Land Disposal Restriction (LDR) concentrations, the media are no longer a RCRA hazardous waste.

SRU2, Metals In Soil, addresses an estimated 22,940 CY of soil contaminated with metals. The selected remedy for SRU2 is Excavation and Disposal (see Section 9.1.3). This remedial action will include the excavation of soil contaminated with metal concentrations above the RGs, confirmatory sampling, and final disposal. The soil will be reused or properly disposed

SRU3, Explosives and Metals in Soil, addresses an estimated 33,120 CY of soil contaminated with metals and explosives. The selected remedies for SRU3 are Bioremediation and Disposal and Excavation and Disposal (see Section 9.1.4). The Army will treat all soils that are RCRA hazardous waste based on explosives contamination in the soil. The Army may treat all other soils in SRU3. Tlie major components of the Bioremediation and Disposal remedy include the excavation of soil contaminated with explosives and metals above RGs, confirmatory sampling, bioremediation process, and, if necessary, solidification/stabilizationprocess. The major components of' the Excavation and Disposal remedy include the excavation of soil contaminated with explosives and metals above the RGs, confirmation sampling, and final disposal. The soil will be reused or properly disposed. The disposal options for treated and untreated soils are presented in Section 9.1.1.5.

Some of the soils in SRU3 were contaminated by RCRA listed hazardous wastes, and as such "contain" these wastes. The Army based its detailed analysis of alternatives and selection of remedial technologies for these SRU3 soils on two determinations. First, media, such as soils, at JOAAP that were contaminated with RCRA listed hazardous wastes, are not themselves hazardous wastes unless they exhibit the characteristic for which the waste was listed. Second, once media contaminated with RCRA listed hazardous wastes are treated to below RGs, are not TCLP hazardous wastes under RCRA, and do not exceed RCRA LDR concentrations, the media are no longer a RCRA hazardous waste.

SRU4, Polychlorinated Biphenyls (PCBs) in Soil, addresses an estimated 3,416 CY of soil contaminated with PCBs. The selected remedy for SRU4 is Excavation and Disposal (see Section 9.1.5). This remedial action will include the excavation of soil contaminated with I1CBs above the RGs, confirmatory sampling, and final disposal. Soils with PCB concentrations below 50 parts per million (ppm) will be disposed at a permitted RCRA Subtitle D landfill, such as the future proposed Will County Landfill (WCLF). Soils with PCB levels between 50 ppm and 500 ppm will be disposed in a

Substances Control Act (TSCA) permitted landfill. Soils with PCB levels greater than 500 ppm will be disposed off-site in accordance with TSCA (e.g., incinerated at an off-site TSCA permitted incinerator).

SRU5, Organics in Soil, addresses an estimated 2,410 CY of soil contaminated with organic compounds. The selected remedy for SRU5 is Excavation and Disposal (see Section 9.1.6). This remedial action includes the excavation of organics-contaminated soil above the RGs, confirmatory sampling, and disposal at a permitted RCRA Subtitle D landfill.

SRU6, Landfills, addresses six landfills or debris piles covering a total of approximately 120 acres. The selected remedies for SRU6 are to cap three of the landfills (L3, M11, M13) and to excavate and dispose of the materials in the other three landfills (L4, M1, M9) (see Section 9.1.7). The capping of three sites will cover an estimated 98 acres. The excavation and disposal at the other three sites will include the excavation of 366,000 CY of contaminated soil, waste segregation, and disposal. Hazardous wastes, if encountered, will be disposed at a permitted RCRA Subtitle C landfill, and non-hazardous wastes will be disposed at a permitted RCRA Subtitle D landfill. The remedy for the capped landfills in SRU6 will result in hazardous substances remaining on-site above risk-based levels.

SRU7, Sulfur, involves two sites where an estimated 7,500 CY of sulfur has been found on and near the surface. Since raw sulfur is not a regulated substance under CERCLA, the cleanup of these sites will be conducted outside of the Army's CERCLA-based program. The cleanup action at this unit includes the excavation and recycling or disposal of raw sulfur off-site (see Section 9.1.8).

Soil NFA sites include 28 sites and two subareas at JOAAP. These sites were suspected of having soil contamination, but upon investigation or following a removal action, they have been found to contain either no evidence of contamination, no contamination, or contamination at concentrations that do not pose a threat to human health or the environment. These 28 sites and two subareas require no further cleanup actions for soil (see Sections 5.1.8 and 6.6).

GRU1, Explosives in Groundwater, addresses an estimated 87 million gallons (MG) of groundwater contaminated with explosives in the LAP area (see Section 9.2.2).

GRU2, Explosives and Other Contaminants in Groundwater, addresses an estimated 541 MG of groundwater contaminated with explosives, **volatile organic compounds** (VOCs) and metals in the MFG area (see Section 9.2.3).

GRU3, VOCs in Groundwater, addresses an estimated 3 MG of groundwater contaminated with VOCs in the MFG area (see Section 9.2.4).

The selected remedy for each of the three GRUs is Limited Action including establishing Groundwater Management Zones, deed and zoning restrictions, periodic site inspections, groundwater and surface water monitoring, and natural attenuation. For the three GRUs, the selected remedies will result in hazardous substances remaining on-site above risk-based levels until remediation is complete.

Groundwater NFA sites include 41 sites and three subareas at JOAAP. These sites were suspected of having groundwater contamination, but upon investigation, have been found to contain either no evidence of contamination, no contamination, or contamination at concentrations that do not pose a threat to human health or the environment. These 45 sites and subareas require no further cleanup actions for groundwater (see Sections 5.2.4 and 6.6).

STATUTORY DETERMINATIONS

The selected remedial actions for all SRUs and GRUs will protect human health and the environment, comply with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial actions, and are cost-effective. These remedies utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. To the maximum extent practicable, they also treat the principal threats posed by the contamination identified at the sites.

Because the remedies selected for the SRUs and GRUs will result in hazardous substances remaining onsite above levels that allow for unlimited use and unrestricted access, a review will be conducted within five years after the commencement of remedial action to ensure that the remedies continue to provide adequate protection of human health and the environment.

Because the actions within SRUs 1, 2, 3 and 5 for USDA lands are interim the review of these lands and the interim remedies will be ongoing as final remedial alternatives are developed.

Raymond J. Fatz
Deputy Assistant Secretary of the Army
(Environment, Safety and Occupational Health)
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OCT 29 1998
Date

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10/30/98
Date

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Date

1. SITE NAME, LOCATION, AND DESCRIPTION

The JOAAP is a former U.S. Army munitions production facility located on approximately 36 square miles (23,542 acres) of land in Will County, Illinois. The JOAAP is located approximately 17 miles south of Joliet and is divided into two main functional areas (Figure 1): the LAP Area (to the east of Route 53) and the MFG Area (to the west of Route 53). Each Area has been listed, by USEPA, on the NPL as a CERCLA site.

The MFG Area, covering approximately 14 square miles (9,159 acres), is where the chemical constituent of munitions, propellants and explosives were manufactured. The production facilities are located in the northern part of the MFG Area. On the southern half of the MFGArea, there is an extensive explosives storage facility. The LAP Area, covering approximately 22 square miles (14,383 acres), is where munitions were loaded, assembled, and packaged for shipping. This area of JOAAP contains munitions filling and assembly lines, storage areas, and a demilitarization area.

The JOAAP is located within the northern part of the extensive Central Lowlands physiographic province, which is characterized by relatively flat topography and low relief The most prominent topographic feature at JOAAP is an approximately 50-foot-high escarpment that trends generally north-south through the installation.

JOAAP lies within the fork of theconfluence of the Des Plaines and Kankakee Rivers. Most of the LAP area drains to the Kankakee River. The Grant Creek and the Prairie Creek drainage basins cover approximately 70 percent of the installation, and the Jackson Creek drainage basin covers the remainder of the JOAAP. Jackson and Grant creeks aretributaries of the Des Plaines River, whereas Prairie Creek eventually discharges to the Kankakee River. Man-made ditches facilitate drainage to these creeks from the sites.

The hydrogeology of the area is subdivided into four aquifer systems and major confining beds. As depicted in Figure 2, from the uppermost downward, the aquifer systems are (1) the glacial drift (Pleistocene glacial deposits), (2) shallow bedrock (Silurian Dolomites), (3) Cambrian-Ordovician (sandstones and dolomites), and (4) Mount Simon (Cambrian sandstone).

Groundwater flow at the MFG Area is generally westward but is locally influenced by streams that are incised into the glacial drift. Groundwater flow occurs in several aquifers beneath the site. The shallow overburden aquifer is composed of glacial drift and is underlain by the Silurian Dolomite water-bearing zone. Deeper bedrock aquifers are isolated from the shallow aquifer by low-permeability shale beds in the Maquoketa Group.

Groundwater at the JOAAP has been determined to be both Class I and Class II, IEPA has classified the glacial drift aquifer as Class II because its low yield does not supply usable quantities of groundwater. The Silurian Dolomite is considered a Class I groundwater resource and it has alimited use in the vicinity of JOAAP as a water source despite elevated levels of sulfate and iron.

In accordance with the Illinois Land Conservation Act of 1995, P.L. 104-106, Div. B, Title 2901-2932, Feb 10, 1996, the Army will transfer JOAAP land to various Federal, local and state jurisdictions. Approximately 19,100 acres will be transferred to the U.S. Department of Agriculture (USDA) for establishing the Midewin National Tallgrass Prairie; 982 acres will be transferred to the Department of Veterans Affairs to establish a Veterans Cemetery; and 455 acres will be transferred to Will County, Illinois to establish the WCLF. Approximately 3,000 acres will be transferred to the State of Illinois to establish two industrial parks. Figure 1 shows the proposed future land use plan for JOAAP.

Once potential hazards to human health and the environment are addressed and the property is found suitable for transfer under Public Law 104-106 and CERCLA, the Army will prepare documentation for transfer. To date, the Army has transferred 15,080 acres to theUSDA and 982 acres to the Department of Veterans Affairs.

[END OF SECTION]

2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

JOAAP was constructed during World War II for the purpose of manufacturing, loading, assembling, packing, and shipping bombs, projectiles, fuses, and supplementary charges. The production output at JOAAP varied with the demand for munitions, Although the plant was used extensively during World War II, in 1945 all production of explosives was halted, the sulfuric acid and ammonium nitrate plants were leased out, and the remaining production facilities were put in layaway status. The installation was reactivated during the Korean War, and again during the Vietnam War. Production at the plant gradually decreased until it was stopped completely in 1977. Since then, various defense contractors under facility-use contracts have utilized some areas of the installation. One such contract is still active and is expected to expire in 1999.

Uniroyal Chemical Company, Inc operated the JOAAP as a government-owned, contract-operated (GOCO) facility until 1993. In April 1993, the property was declared as excess by the Army and is now being maintained by a small staff. The JOAAP is presently under liquidation status. The facility is not capable of explosives production and is undergoing transfer of use to other agencies and organizations in accordance with Public Law 104-106.

In 1978, the U.S. Army Environmental Center (USAEC, formerly the U.S. Army Toxic and Hazardous Materials Agency or USATHAMA) conducted an Installation Assessment of JOAAP (USATHAMA, 1978), which consisted of records search and interviews with employees. This document reported that environmental impacts might be present at former industrial areas and locations where waste disposal activities occurred.

During 1981 and 1982, an Installation Restoration Survey was conducted (Donohue and Associates, 1982). This study included sampling soils, groundwater, surface water, and sediment, and identified the presence of contamination at nine study areas at the MFG Area and nine study areas at the LAP Area.

Subsequently, a Phase II study was conducted in 1983 (Donohue and Associates, 1983) to gather additional data on the previously sampled sites at the MFG and LAP Areas, and to evaluate the potential for off-site impacts. This investigation also included an assessment of several parcels of land near the edge of the MFG Area that JOAAP wanted to excess (sell). No off-site contamination was identified.

From 1983 through 1985, a remedial action was conducted by Uniroyal (JOAAP's operating contractor) at the Red Water lagoon located at site M7. The purpose of this remedial action was to remove contaminated surface water and sediment from the lagoon. Following the removal of contaminated materials, a clay cap was installed over the lagoon. Pre- and post-remediation sampling documented the conditions before and after the remediation (Donohue and Associates, 1983, 1985).

Between 1983 and 1985, the U.S. Army Environmental Hygiene Agency (AEHA; now U.S. Army Center for Health Promotion and Preventive Medicine, CHPPM) performed groundwater sampling of selected existing monitoring wells. The sampling and monitoring were performed as part of JOAAP's RCRA groundwater monitoring program around a closed sanitary landfill located at site M13, and the Red Water lagoon at site M7.

In November 1984, because of the presence of contamination, the MFG Area of JOAAP was proposed for listing on the NPL by the USEPA based on the Hazard Ranking System (HRS) score 32.08. The LAP Area was proposed for listing in April 1985 based on the HRS score 35.23. Final listing on the NPL took place on July 21, 1987 for the MFG Area, and March 31, 1989 for the LAP Area.

During 1985 and 1986, additional groundwater and surface water samples were collected from previously sampled locations at the MFG and LAP Areas. This data was presented in an assessment report in which the feasibility and need for remediation of the study areas was discussed (Dames & Moore, 1986).

In 1989, the Army, the USEPA and the IEPA entered into a Federal Facilities Agreement (FFA) under CERCLA Section 120 and RCRA Sections 6001, 3008(h), 3004(u), and 3004(v) (USEPA, 1989). The purpose of this FFA was to ensure that environmental impacts at the site would be investigated and that remedial actions would be taken to protect public health, welfare, and the environment.

Also during 1989, the U.S. Army Corps of Engineers (USACE) made an investigation of underground storage tanks (USTs) throughout the JOAAP (USACE, 1989). One hundred seven USTs were identified, inventoried, and evaluated for possible leakage in accordance with USEPA regulations for existing USTs. Most of the USTs were emptied and removed as of 1993.

From 1988 through 1993, Phase 1 and Phase 2 Remedial Investigations (RIs) were conducted at the MFG Area (Dames & Moore, 1991, 1993). The RIs were performed to identify the type, concentration, and extent of contamination throughout the MFG Area at JOAAP. A total of 18 study areas were identified for investigation, including nine areas originally investigated during previous studies. These reports were amended by the Oleum, Plant RI report (Dames & Moore, 1996) that was added as a potentially contaminated area following the completion of the RI reports.

From 1991 through 1994, Phase 1 and Phase 2 RIs were conducted at the LAP Area for the same purposes as the MFG Area investigations (Dames & Moore, 1993; 1994). A total of 35 study areas were investigated, including nine sites investigated during the Installation Restoration Surveys at the LAP Area.

The RI reports were supplemented by baseline risk assessments conducted to quantify the potential human health risks posed by contamination identified at the study sites present at the MFG and LAP Areas (Dames & Moore, 1994; 1995). The assessments included an environmental fate and transport assessment, a toxicity assessment, an exposure assessment, and a risk characterization.

From 1993 through 1996, the U.S. Army CHPPM conducted an ecological risk assessment to evaluate the potential for site contamination to be impacting ecological receptors. Findings indicated limited impacts to terrestrial mammals, aquatic receptors, and avian species (birds). The results of these studies were presented in a Phase 1 Ecological Risk Assessment Report (USACHPPM, 1994) and a Phase 2 Aquatic Ecological Risk Assessment Report (USACHPPM, 1996). Potential risks posed to humans from consuming deer tissue from JOAAP were also investigated and determined to be negligible (USACHPPM, 1994)

Following the risk assessments, Preliminary Remediation Goals (PRGs) were established to identify the specific cleanup to remediate the sites (OHM, 1996). The cleanup levels were developed to be protective of human health and the environment.

In 1996 and 1997, the USACE conducted four removal actions to prevent the migration of contaminants from source areas. Wastes present in the oil pits located at study area L2 were excavated and disposed to prevent the contaminants present in these wastesfrom migrating into the groundwater. During the same time period, the Omaha District, Corps of Engineers, conducted a Removal Action along Prairie Creek at site L3. This action involved stabilizing the stream bank to prevent the erosion of the bank that contained buried debris and wastes. Also in 1996, the Louisville District Corps of Engineers conducted the removal of the PCB switch boxes from the MFG Area. Soils around the switch boxes were sampled and subsequently removed if contamination was above RGs or if staining was noticeable. in 1997, an interim Removal Action was performed at the southern ash pile (M1). This project involved consolidating wastes that had migrated from the pile and covering the pile with a geosynthetic liner to prevent leaching of wastes from the pile. Also in 1997, the Louisville District, Corps of Engineers, conducted a Removal Action at site L6. This action involved the excavation and disposal of organics- and PCB-contaminated soil to protect human health and the environment. This action also was intended to facilitate the transfer of the land from the Army to Will County in accordance with Public Law 104-106 for establishing a landfill.

Public Law 104-106 of the Fiscal Year 1996 Department of Defense Authorization Act legislated specific terms relating to the conveyance of JOAAP to various entities. This law is the governing document for the future land use at JOAAP. The majority of JOAAP is to be transferred to the U.S. Department of Agriculture (USDA), with the U.S. Department of Veterans Affairs, Will County, and the State of Illinois receiving the remainder of the property. Figure 1 identifies the plannedfuture land use of JOAAP under this law.

Since the volume of explosives-contaminated soil may have adirect bearing on the selected remediation method, field screening soil sampling programs were conducted in 1995 to provide data to more accurately estimate the volume of explosives-contaminated soils on the MFG and LAP Areas. These programs were supplemented by sampling to help characterize the types of wastes present, and the results of the sampling programs were used in the Feasibility Studies (FSs) for the MFG and LAP Areas. The purpose of the FSs was to identify and evaluate alternative remedies for mitigating the risks posed by contamination at JOAAP. Separate FSs were prepared for the Groundwater and Soil 0perable Units for both the LAP (Dames & Moore, 1997) and MFG (OHM, 1997) Areas. Based on the information gathered and presented in the FSs, the Army recommended, with USEPA and IEPA concurrence, the preferred remedies for the contaminated soil and groundwater at JOAAP. The rationale behind the selection of the remedies was released to the general public in the Proposed Plan for the Soil Operable Unit andthe Proposed Plan for the Groundwater Operable Unit (U.S. Army, 1997 a, b) and presented at a public meeting on January 8, 1998.

Alliant Techsystems, Inc., under a facility-use contract to the U.S. Army currently uses a portion of LAP area. Any contamination resulting from this activity will be remediated as required by the contract, applicable laws and regulations.

Liquidation/demolition activities have been underway in the Manufacturing (MFG) Area. This action has removed many property items and many buildings, and has potentially changed the extent of contamination previously determined in the RI and FS reports. The remedies selected for the soil and groundwater OUs will take into account any changes in conditions that are a result of the past and ongoing liquidation/demolition activities.

[END OF SECTION]

3 HIGHLIGHTS OF COMMUNITY PARTICIPATION

The Army has made major documents concerning the CERCLA activities at JOAAP available to the public at three information repositories in the vicinity of the installation. These three repositories are located at the JOAAP office, the Wilmington Public Library in Wilmington, and the Joliet Public Library in Joliet.

The Proposed Plan for the Soil Operable Unit and the Proposed Plan for the Groundwater Operable Unit were released to the public on December 12, 1997. The notice of availability of' these documents was published in the Joliet Herald News and the Wilmington Free Press newspapers on December 14, 1997. A 30-day public comment period on both Proposed Plans extended from December 12, 1997, through January 15, 1998. In addition, a public meeting was held during the public comment period on Thursday, January 8, 1998. At that meeting, representatives from the Army, USEPA, and IEPA presented a summary of the project and answered questions relating to the Proposed Plans. Written and oral comments received at this meeting, as well as written comments received during the public comment period, which are relevant to the Proposed Plans, were responded to in the Responsiveness Summary section of this document.

The JOAAP Restoration Advisory Board (RAB) was established in December 1995 to facilitate communication and coordination between community and governmental agencies related to the restoration of the JOAAP. The RAB is intended to bring together members who reflect the diverse interests within the local community. The RAB has held its regular monthly meetings at the Wilmington City Council Chambers since January 1996. In 1996 and 1997, the JOAAP RAB field open forums, discussed upcoming studies, took field trips to visit other RABs, provided input on the Proposed Plans and ROD, and participated in deciding removal action projects conducted in 1997 and 1998. In July 1997, the RAB hosted a press tour of the JOAAP facility in order to promote information exchange among the community and the installation. The event, sponsored by the JOAAP, was open to members of the local and regional media and the public. Prior to the formation of the RAB, Technical Review Committee meetings were held regularly to inform the public about the ongoing environmental studies in accordance with JOAAP's Public Involvement Response Plan (Dames & Moore, 1990).

[END OF SECTION)

4 SCOPE AND ROLE OF OPERABLE UNITS OR RESPONSE ACTIONS

Past releases and disposal practices at JOAAP have resulted in soil and groundwater contamination with explosives compounds, metals, organics, PCBs, sulfur, and inorganic hazardous and non-hazardous debris. The goal of the overall cleanup activities at JOAAP is to eliminate or reduce the levels of contaminants to concentrations that are protective to human health and the environment, such that no adverse health effects or adverse ecological impacts will result from future uses of the JOAAP property.

The contaminated media identified at JOAAP were divided into two operable units (OUs) to aid in the development, evaluation, and selection of remedies. The soil operable unit (SOU) consists of sites where contaminated soils, sediments, and debris were identified. The groundwater operable unit (GOU) consists of sites where contaminated groundwater plumes were identified. Based on the Risk Assessment studies, surface waters studied at JOAAP have been determined to pose no risk to human health and the environment and, therefore, are not addressed further. This ROD addresses both soil and groundwater OUs.

4.1 Soil OU

Fifty-three (53) sites plus three (3) subareas were investigated within the SOU. Twenty-six sites were found to require remedial action and were grouped into seven SRUs according to the type of contamination discovered. These seven SRUs are summarized in Table 4-1 and described in more detail in Section 5. 1.

Figure 3 depicts the sites within each SRU. In some instances, different types of contamination were discovered at different locations within the site; therefore, the same study site may appear in more than one SRU. Sites within the SRUs to be remediated are distinguished by whether they are on land designated for the State of Illinois for industrial parks or on land currently managed by or intended for the USDA for the Midewin National Tallgrass Prairie (USDA lands)(see Figures 1 and 3). This distinction is needed to determine whether the selected remedial actions are considered interim or final within this ROD (see Table 4. 1). Twenty-five (25) sites and one subarea were found to require further cleanup action. Twenty-eight (28) sites and two subareas of contaminated sites were found to require no further cleanup action for soil under CERCLA. Refer to Sections 5.1.8 and 6.6 for more detailed discussion of sites requiring no further cleanup actions.

4.2 Groundwater OU

Within the GOU, contaminated plumes were grouped into three GRUs according to the type of contamination they contained and their geographic location. Figure 4 depicts these plumes and their corresponding GRUs. The three GRUs are summarized in Table 4-1 and described in more detail in Section 5.2. The groundwater under twelve (12) sites was found to require further cleanup action. Forty-one (41) sites and three subareas of contaminated sites were found to require no further cleanup action for groundwater under CERCLA. Refer to Sections 5.2.4 and 6.6 for more detailed discussion of sites requiring no further cleanup action.

4.3 Final and Interim Actions

This ROD presents final response actions for all groundwater, all industrial lands soils, and SRUs 4, 6, and 7, as applicable, to USDA lands. The purpose of these final response actions is to protect human health and the environment by cleaning up and preventing exposure to contaminants in soil and groundwater and to eliminate the potential for contaminated soils to be a continuing source of groundwater contamination.

This ROD presents interim actions for SRUs 1, 2, 3, and 5 as applicable to USDA kinds. The goal of the interim actions is to remove sources of contamination to groundwater and/or to prevent the further migration of contamination. Subsequent actions are planned to fully address the threats posed by the conditions at SRUs 1, 2, 3, and 5 for USDA lands. The interim actions will be consistent with any planned future remedial actions for USDA lands. The Army will present recommended final remedial alternatives to the public in a proposed plan. The public will be provided an opportunity to comment on the preferred alternative(s) prior to remedy selection. A finalRecord of Decision will be prepared in accordance with the NCP.

Table 4-1: Soil and Groundwater Remedial Units

SRUs /GRUs	**Description**	**Primary Contaminants of Concern**	**Final Remedial Action Sites**	**Interim Remedial Action Sites**
		Soils Operable Unit		
SRU1	Explosives	DNT, NT, TNB, TNT, HMX, RDX, Tetryl	L16, M5, M6, M7	L1, L7, L8, L9, L10, L14, M2, M3
SRU2	Metals	Arsenic, Beryllium, Lead, Cadmium	L11	L2, L3, L5, L23A, M3, M4, M12
SRU3	Explosives and Metals	DNT, TNT, RDX, Arsenic, Beryllium, Lead	M5, M6	L2, L3
SRU4	PCBs	PCB1254, PCB 1260	L1, L5, L7, L8, L9, L10, L17	
SRU5	Organics	Total Petroleum Hydrocarbons		L1, L5
SRU6	Landfills	Hazardous and Non-hazardous Wastes	L3, L4, M1, M9, M11, M13	
SRU7	Sulfur	Sulfur	M8, M12	
		Groundwater Operable Unit		
GRU1	Explosives	DNT, TNB, TNT, RDX, NT	L1, L2, L3, L14	
GRU2	Explosives and Other Contaminants	DNT, TNB, TNT, HMX, RDX, NB, DNB, PCE, Iron, Antimony, Cadmium	M1, M5, M6, M7, M8, M13	
GRU3	VOC	Benzene, Toluene	M3, M10 (Western and Central Tank Farms	

Note: Sites beginning with letter "L" are in the LAP Area; with the letter "M" are in the Manufacturing Area

[END OF SECTION]

5 SITE CHARACTERISTICS

This section provides an overview of the site characterization of the MFG and LAP Areas, including the nature and extent of soil and groundwater contamination. The information presented in this section has been summarized from the RI and FS reports (Dames & Moore, 1997, OHM, 1997). Site numbers represent study sites; Group numbers represent building clusters.

During the RIs, numerous samples were taken to determine the nature and extent of contamination of the soils, sediments, surface water, and groundwater. Surface and subsurface soil samples were taken using hand augers, drilling rigs and backhoes. The horizontal and vertical extent of contamination was analyzed at each site. Surface water and sediment samples were taken to determine whether or not contaminants had moved into, and remained in the sumps, drainage ditches, creeks, and lakes. Existing on-site wells and shallow and deeper wells in the area ofJOAAP were sampled. New wells were drilled, established, and sampled. Groundwater probes were driven and sampled. Potential discharge points of groundwater into surface waters were sampled. The findings of these investigations provided the basis for the extent of soil contamination as shown in Figure 3 and the contaminant plumes shown in Figure 4. Detailed descriptions of the sampling program and the discovered plumes may be found in the RI/FS reports. The nature and extent of contamination found in each SRU and GRU is described below.

5.1 Soil OU

5.1.1 SRU1, Explosives in Soil

SRU1, Explosives in Soil, contains the majority of the contaminated soils at JOAAP and poses the principal threat to human health and the environment if not remediated. Most of this contamination is found at sites M5 and M6 where the explosives TNT, DNT, and Tetryl were manufactured. The contamination is generally confined to the surface soils in the immediate vicinity of the production buildings and drainage ditches that received contaminated wastewaterduring production. A total of 12 sites are grouped under this SRU, as shown in Table 5-1. Five of these sites are within the MFG Area and seven are within the LAP Area, as shown in Figure 3. It should be noted that only certain subareas under each site are included in this SRU and not the entire site. Table 5-1 lists the subareas and the estimated volume of soil/sediment that needs to be remediated. Table 5-2 lists exceedances of Remedial Goals (RGs) for sites included in SRU1

5.1.1.1 Site L1 (Group 61)

Site L1 was constructed in 1941 as part of the initial operations of the installation to support World War II efforts. This 80-acre site is centrally located in the northern portion of the LAP Area. Site Ll was the location of demilitarization and reclamation of various munitions. It was originally used for crystallizing ammonium nitrates, but then extensively modified to function as a shell renovation and 1,3,5-trinitrobenzene (TNB) recovery plant until 1945. In April 1946, the facility was reactivated to reclaim TNT. Washout operations involving the larger munitions were performed outside Building 61-35, which is located southeast of Building 61-4. The solids that settled in the sump were sent to Site L2 (Explosive Burning Grounds), while the overflow from the sump (pink water) was discharged to an adjacent 4.3-acre ridge-and-furrow system (or evaporating bed).

Historical aerial photos revealed that by 1952 two rectangular pits or lagoons were constructed southeast of the ridge-and-furrow system on either side of drainage ditch that flows south from the ridge-and furrow system and empties into Prairie Creek.

Explosives contamination appears to be limited to the ridge-and- furrow system, the western lagoon south of the evaporation beds, and south of the washout building and around the sump building. It has been estimated that 85 percent of the 4.3-acre area is contaminated with explosives above RGs to a foot depth (5,925 CY). The area requiring remedial action at the washout building and sump is limited to the stained area and includes an estimated volume of 40 CY of contaminated surface soil, assuming the depth of contamination above RGs extends to 1 foot. Subsurface soils were determined to be contaminated an additional 2 feet in depth to the west side of the sump. Other contaminated materials include: subsurface soil beside the sump building (45 CY), sump sediment (50 CY) and pipelines (5 CY). The total volume of explosives-contaminated soil from Site L1 areas requiring remedial action is approximately 6,065 CY.

The explosive 2,4,6-TNT is considered tobe a contaminant in the sump surface water. The presence of the explosive 2,4,6-TNT in the sediment from the ditch indicates that runoff from the ridge-and-furrow system may have periodically transported contaminants to Prairie Creek.

No RCRA hazardous wastes were identified at Site Ll.

Table 5-1: Sites and Subareas of SRU1 (Explosives in Soil)

Sites	**Subareas**	**Estimated Volumes (CY)**
L1	Ridge and furrow system	5,925
	Near Building 61-4 and Building 61-35 sump	140
L7	Around and beneath buildings and sumps	1,850
L8	Around and beneath buildings and sumps	400
L9	Around and beneath buildings and sumps	1,500
L10	Around and beneath buildings and sumps	915
	Sediment in Drainage ditch south of Building 3A-10	745
L14	Soil near sump at Building 4-5	420
L16	Soil at sump discharge near Building 6-32	85
M2	The northern portion of the explosive burning ground and the wetland separating M2 and M11	1,600
M3	Between primary burning pads and a dumping area/pad	400
M5	Around and beneath buildings and ditches throughout the site	12,000
M6	Around and beneath buildings and ditches throughout the site	121,000
M7	Soil in the TNT Ditch and Red Water Area	4,500
Total		**151,480**

5.1.1.2 Site L7 (Group 1)

Site L7 is located in the southern portion of the LAParea. The basic processes and procedures involved in LAP operations are similar for all ammunition items. Explosives were melted and loaded into a projectile; process water containingexplosives residue was discharged to sumps. The loaded projectiles were then transferred to another building for final assembly. Solids collected in the sump were reportedly sent to the Explosive Burning Grounds (Site L2) for disposal. Liquids from the sump were discharged to a storm sewer, which ultimately discharged to Site L12 (Doyle Lake) from Sites L7, L8, and L10, or to Prairie Creek from Site L9. According to JOAAP personnel, carbon treatment units were installed in each melt-load building around 1976. Spent carbon units were disposed of at the Explosive Burning Grounds.

Explosives contaminants in soil at Site L7 include 2,4,6-TNT, and RDX. Levels of explosives, up to 1.5 percent, were identified in soil from red-stained areas adjacent to buildings throughout the site. The total volume of affected soil for Site L7 is estimated to be approximately 1,850 CY.

No RCRA hazardous wastes were identified at Site L7.

5.1.1.3 Site L8 (Group 2)

Site L8 is centrally located in the LAP Area, east of the intersection of Chicago and Central Roads. LAP operations performed at the site included: melting and loading of Composition B into projectiles, subsequent cleaning and washdown operations that produced pink-water, and discharge of this waste water to external sumps and surface areas.

Explosives contaminants in soil at Site L8 include 2,4,6-TNT and 2,4-DNT. High levels of explosives, up to 1.6 percent, were identified in soil from red-stained areas adjacent to buildings throughout the site. In addition, high levels of explosives were detected beneath one washout building (2-40B). Detectable concentrations of explosives occur in soils to a depth of 5 feet. The total volume of affected soil, including areas beneath building foundations, is estimated to be approximately 400 CY. The volume of raw TNT is estimated to be 1 CY. Additionally, a total of 15 CY of structural concrete in the sump areas is estimated for disposal.

The only RCRA hazardous waste identified at Site L8 is raw TNT which is hazardous based on its reactivity (waste code D003).

5.1.1.4 Site L9 (Group 3)

Site L9 is located in the central part of the LAP Area, 1 mile east of the intersection of Chicago and Central Roads. Operations were similar to those described for Sites L7 and L8.

Explosives contaminants of concern for soil at Site L9 include 1,3,5-TNB and 2,4,6-TNT. High levels of explosives, up to 4 percent, have been identified in soil from red-stained areas adjacent to buildings throughout the site. High levels of RDX contamination occur in a few locations beyond stained areas and are not as apparent as surrounding TNT contamination. The total volume of affected soil, including areas beneath building foundations, is estimated to be approximately 1,500 CY. The volume of raw TNT is estimated to be 1 CY. Additionally, a total of 15 CY of structural concrete in the sumps area is estimated for disposal.

The only RCRA hazardous waste identified at Site L9 is raw TNT which is hazardous based on its reactivity (waste code D003).

5.1.1.5 Site L10 (Group 3A)

Site L10 is located in the central part of the LAP Area, between Sites L7 and L8. LAP operations performed at Site L10 were similar to those described for Site L7.

Explosive contaminants of concern for soil at Site L10 are 2,4,6-TNT, 2,4-DNT, HMX, and RDX. High levels of explosives, up to 13.8 percent, have been identified in surface soil from visually stained areas adjacent to buildings and sumps throughout the site. High concentrations of RDX occur in some locations where staining is absent and vegetation is present. Explosives were detected in heavily contaminated surface areas, beneath the foundation of one sump building, 3A-53, and next to the manhole near Building 3A-12. The total volume of affected soil at Site L10 is estimated to be 915 CY. Sediment contamination is assumed to be near the southern end of the Site L10 where the small drainage ditch flows into a tributary to Jordan Creek. The total volume of affected sediment at Site L10 is estimated to be 745 CY. The volume of raw TNT is estimated to be 1 CY. Additionally, a total of 58 CY of structural concrete in the sumps area is estimated for disposal.

The only RCRA hazardous waste identified at Site L10 is raw TNT which is hazardous based on its reactivity (waste code D003).

5.1.1.6 Site L14 (Group 4)

Site L14 is a 33-acre site located in the southwestem comer of the LAP Area, near Sites L15 through L19. It was initially constructed to produce various types of fuses. Mercury fulminate, reportedly stored at Site L14, was loaded into the fuses in the assembly line building (Building 4-14). After 1945, Building 4-14 was used for repackaging smokeless powder. According to JOAAP personnel, a sump north of Building 4-5 periodically overflowed resulting in soil contamination in this area.

Explosives contaminants of concern include 2,4,6-TNT, and RDX. The highest concentrations of explosives (total concentrations of approximately 55,000 µg/g) were detected in surface soil near the large sump north of Building 4-5. Explosive concentrations decreased with depth, but were detectable in the deepest samples collected (at 5 feet). Total explosives concentrations in soil samples from all other areas at Site L14 were below Remediation Goals. The total volume of affected soil and sediment at Site L14 is estimated to be 420 CY. Additionally, a total of 20 CY of structural concrete in the sump area is estimated for disposal.

No RCRA hazardous wastes were identified at Site L14.

5.1.1.7 L16 (Group 6)

Site L16, a site of approximately 90 acres, is located in the southwestern corner of the LAP Area. Site L16 was initially constructed forthe production of boosters for munitions. These sumps received wastewater during production activities at Buildings 6-2, 6-4, and 6-32, which then discharged into drainage ditches.

Explosives contaminants of concern include HMX, and RDX. High levels of RDX and HMX occur in soil primarily in a drainage ditch north of Building 6-32; at the outfall of the sump. Other areas of explosive contamination occur around the sump at Buildings 6-32, at entrances/exits to Building 6-2, and along the tile flume extending west from the sump at Building 6-4. The total volume of affected soil and sediment at Site L16 is estimated to be 85 CY. Additionally, a total of 5 CY of structural concrete in the sumps area is estimated for disposal.

No RCRA hazardous wastes were identified at Site L16.

5.1.1.8 Site M2 (Explosive Burning Ground)

Site M2 covers approximately 25 acres in the south central part of the MFG Area. Open burning of explosive wastes was performed on a 4-acre burning pad until 1965. The burning pad consists of gravel placed over the topsoil. Multiple areas of explosives-stained soil, absent of vegetation, are visible in the northern portion of this site. Berms surround much of the burning pad area. A wetland area is present to the north of the burning pad area and along the eastern boundary of M2.

More than 400 tons of suspected "red water ash" were encapsulated in an impermeable membrane and buried at a shallow depth in the northern section of the explosives burning pad. The color, odor, texture, and apparent solubility of the buried waste are indicative of potentially untreated explosives sludge.

Explosives contaminants of concern for soil at Site M2 include 1,3,5-TNB, 2,4,6-TNT, 2,4-DNT, and 2,6-DNT. The volume of explosives-stained soil in M2 exceeding the RGs is estimated to be 830 CY. The area of stressed vegetation in M2, without observable explosive, residue is estimated to represent an additional 500 CY of soil. Additionally, there is an estimated 270 CY of material in the "ash pillow."

Soils at M2 may include the following RCRA characteristic waste: soil contaminated with TCLP extractable 2,4-DNT (RCRA waste code D030).

5.1.1.9 Site M3 (Flashing Grounds)

Site M3 covers an area of approximately 66 acres located in the west central portion of the MFG Area adjacent to Grant Creek. From 1942 until 1988, the principal activity in M3 was the flash burning of equipment and demolition materials to remove explosives residues. The flash burning has been performed at two primary locations within a 6-acre fenced area. An area of explosives-stained soil, where trucks were washed after dumping explosives materials, is located between the primary burning pads and a dumping area/pad.

Four additional burning pads, located to the south of the fenced area of M3, were identified in aerial photographs. Each of these secondary burning pads in the central portion of M3 is estimated to be 2 acres.. Numerous craters, located adjacent to the burning pads, may be indicative of TNT block testing. Later photographs indicate that the area containing these southernmost burning pads had been covered with a layer of soil by 1953 but portions of the pads are still visible.

Explosives contaminants of concern for soil at Site M3 include 1,3,5-TNB, 2,4,6-TNT, and 2,4-DNT. Based on the data collected in M2 and the non-intrusive nature of the flashing operation, the vertical extent of explosives contamination that exceeds the RGs is assumed to be limited to one foot. The total volume of explosives and TPH impacted soil is estimated to be 400 CY.

Soils at M3 may include the following RCRA characteristic wastes: soils contaminated with TCLP extractable 2,4-DNT (RCRA waste code D030) and soils contaminated with TCLP extractable lead (RCRA waste code D008).

5.1.1.10 Site M5 (Tetryl Production Area)

M5 consists of approximately 244 acres located in the central portion of the MFG Area. The principal activity in M5 was the production of tetryl. Tetryl was manufactured during World War II, the Korean War, and again during the Vietnam War until 1973. The Tetryl Ditch (oriented from north to south) bisects M5 with Production Lines 1 through 6 located west of the ditch and Productions Lines 7 through 12 constructed to the east of the ditch. Lines 1-6 were burned and removed, The Nitrating (“East-West”) Ditch lies immediately to the north of the nitrating buildings in the tetryl production lines.

Each of the 12 tetryl production lines consisted of four separate "houses," oriented north to south, for nitrating, refining, wet storage ("lag-house") and drying. Wastewater from the tetryl manufacturing processes in the nitrating and refining houses flowed into settling boxes located on the west side of the buildings. Wastewater from the nitrating building was discharged into open drainage ditches that flowed to the north into the Nitrating Ditch. The Nitrating Ditch drains into the Tetryl Ditch that ultimately drains into Grant Creek to the southof the Tetryl Production Area. Tetryl is visible within the settling boxes at the refining houses.

Wastewater from acid spills and daily floor cleaning was discharged from floor drains directly to the settling boxes at the nitrating and refining houses. Additionally, dust traps were constructed outside of the eastern doors of these buildings to collect tetryl residues.

The primary wastewater from the tetryl drying process was discharged to a settling box constructed immediately to the west of each drying house. Tetryl is visible within these settling boxes for Production Lines 7 through 12. A concrete weir was constructed in the Nitrating Ditch that formed a settling basin to the south of the acid recovery building for Tetryl Production Lines 7 through 12. Crystalline explosives compounds are visible in the basin sediment where the wastewater from the AFR building and the nitrating buildings on Production Lines 10, 11, and 12 collected.

Explosives contaminants of concern for soil at Site M5 include 1,3,5-TNB, 2,4,6-TNT, 2,4-DNT, tetryl, and 2,6-DNT. Areas with tetryl contamination at levels greater than the RG include the entire 2,800-foot length of the Nitrating Ditch to a depth of 5 feet. The Nitrating Ditch represents 3,100 CY of explosives-contaminated soil. Tetryl concentrations above the RGs are also present at each of the 24 settling boxes and associated culverts constructed in Tetryl Production Lines 7 through 12. These locations represent approximately 500 CY of contaminated soil. Tetryl residues within the dust traps constructed at the entrances to each of the nitrating and refining houses represent an additional 200 CY of contaminated soil. Approximately 100 CY of tetryl-contaminated soil has been identified within a 3,200 square feet area at the packing and shipping houses to the south of Tetryl Production Lines 7 through 12. Data indicate that high concentrations of tetryl residues are limited to a depth of 1 foot. A similar volume of contaminated soil appears to be present at the corresponding locations for the packing and shipping houses to the south of former Tetryl Production Lines 1 through 6. Approximately 100 CY of tetryl-contaminated soil has been identified adjacent to bulk storage tanks located to the southwest of the AFR Building. A similar volume of contaminated soil appears to be present at the AFR Building location to the north of former Tetryl Production Lines 1 through 6. The volume of tetryl-contaminated soil at the former building locations to the west of the Tetryl Ditch is estimated to be 8,000 CY. The total volume of explosives-contaminated soils within M5 is estimated to be approximately 12,000 CY.

Soils at M5 may include the RCRA characteristic waste of TCLP-extractable lead (RCRA waste code D008), as well as soils contaminated with explosives at concentrations greater than 10 percent indicating they may be RCRA characteristic wastes based on their reactivity (RCRA waste code D003).

5.1.1.11 Site M6 (TNT Ditch Complex)

Site M6 covers approximately 271 acres, located in the central part of the MFG Area. During World War II, the production of TNT and DNT were the major activities in M6. The TNT production lines were again operated at full capacity for the Korean and Vietnam Wars. During each of the inter-war periods, the plant mission was changed to a research and development (R&D) role in which explosive compounds, such as nitroxylenes, were produced. TNT production ceased in 1977.

Twelve parallel TNT "batch" production lines were initially constructed in the TNT Ditch Complex from south to north. The principal buildings in each TNT production line were oriented east to west. The batch production lines were constructed in pairs; each line began with a "mono-house," then a "bi-house," followed by a "tri-house" for the nitration of toluene.

The TNT process wastewater from each tri-house and wash house, known as "red-water," was initially discharged from wooden holding tanks to open clay-lined ditches that drained into the 9,100-foot-long "TNT Ditch." The original wastewater drainage system, specific to the wash houses, was replaced in 1965 by a system of wooden flumes constructed in the TNT Ditch. The wash house red water was then diverted to the Red Water Area for treatment. The Red Water Area, M7, was constructed at the southern end of the TNT Ditch Complex.

DNT-contaminated wastewater from the bi-houses and DNT sweating-and-graining buildings was discharged via wooden settling tanks into open troughs and ditches that flowed directly into the stormwater sewer system and discharged into the TNT Ditch. Wastewater discharged directly to the TNT Ditch was not treated in the Red Water Area and flowed directly into Grant Creek.

Occasionally, operational problems developed during the nitrating processes. To avoid potential explosion hazards, the explosives batch in progress could be flooded in water stored in large wooden “drowning” tubs. During the period from March 16, 1972 through September 14, 1974, there were more than 30 recorded instances in which batches of explosives were drowned. The batch drownings primarily occurred at the tri-houses during the final nitration step. Approximately 4,800 pounds of DNT “bi-oil,” 5,600 pounds of Oleum, and 2,800 pounds of nitric acid were released to the TNT Ditch with each event. Similar drowning tubs were located at each bi-house.

Explosives contaminants of concern for soil at Site M6 include 1,3,5-TNB, 2,4,6-TNT, 2,4-DNT, 2,6-DNT, 2-NT, and RDX. The areas of contamination exceeding clean up levels include soils adjacent to each of the TNT wash houses, bi-houses, tri-houses, between the wash houses and the TNT Ditch, at the AFR Buildings, and around the perimeter of the laboratory building. The total volume of soils and sediment in M6 contaminated with explosives is estimated to be 121,000 CY.

Soils at M6 may include the following RCRA characteristic wastes: soils contaminated with TCLP extractable 2,4-DNT (RCRA waste code D030) and soils contaminated with TCLP extractable lead (RCRA waste code D008). The soils at M6 may also contain RCRA-listed wastes if contaminated with redwater (RCRA waste code K047) and DNT production waste waters (RCRA waste code K111).

Table 5-2 Exceedances of Remediation Goals (RGs)
as a Function of Land Use for Soil Found in SRU1

MIDEWIN TALLGRASS PRAIRIE AREAS (USDA)									
Site		**L1**	**L7**	**L8**	**L9**	**L10**	**L14**	**M2**	**M3**
Explosives	**RG (µg/g)**	**Maximum Concentration Exceeding recreational RGs (µg/g)**							
1,3,5-TNB	180				3,900			2,610	300
2,4,6-TNT	290	22,000	1,500	16,000	180,000	44,000	13,000	72,300	4,100
2,4-DNT	13			16.7		110		522	17.5
2,6-DNT	13							139	
HMX	10,000					17,000			
RDX	78		85		22,900	77,000	42,000		
Tetryl	7,400								
Contaminated Soil Volume (CY), Total <u>13,895</u> (1		6,065	1,850	400	1,500	1,660	420	1,600	400

INDUSTRIAL PARK AREAS					
Site		**L16**	**M5**	**M6**	**M7**
Explosives	**RG (µg/g)**	**Maximum Concentration Exceeding Industrial RGs (µg/g)**			
1,2,5-TNB	100		120	600	1,100
2,4,6-TNT	190		16,00	482,000	190,000
2,4-DNT	8.4		25.5	86,709	1,700
2,6-DNT	8.4		20	2,540	90
2-NT	10,000			18,500	
HMX	10,000	19,000			
RDX	52	65,000		1,400	76
Tetryl	4,100		224,000		
Contamianted Soil Volume (CY), Total <u>137,585</u> (1)		85	12,000	121,000	4,500

Notes: (1) Total Contaminated Soil volume for USDA and Industrial Park <u>151,480 CY</u>.

5.1.1.12 Site M7 (Red Water Area)

Site M7 covers approximately 49 acres located in the central part of the MFG Area immediately to the south of the TNT Ditch Complex. The TNT Ditch forms the eastern boundary of M7. Facilities within M7 include three separate groups of storage tanks, pumping stations, evaporators, and incinerators. Beginning in 1965, these facilities were used to treat wastewater (red water) containing explosives residues and derivatives produced in the TNT manufacturing process. At that time, red water from the TNT wash houses was diverted from the TNT Ditch into wooden flumes. The red water was collected in storage tanks to the south of the TNT Ditch Complex. Overflow of untreated red water was stored in the Red Water Lagoon, located in the northern portion of M7. This 3.3-acre lagoon, with a capacity of 4.1 million gallons, was remediated in 1985.

Explosives contaminants of concern for soil at Site M7 include 1,3,5-TNB, 2,4,6-TNT, 2,4-DNT, RDX, and 2,6-DNT. The areas of contamination exceeding clean up levels include soils in the drainage areas with stained soil located in the northwest portion of the Red Water Area. The total volume of explosive-contaminated soil in M7 is estimated to be 4,500 CY.

Soils at the M7 site may be considered listed wastes if contaminatedwith red water (RCRA waste code K047) and DNT production waste waters (RCRA waste code K111).

<u>5.1.2 SRU2, Metals in Soil</u>

SRU2, Metals in Soil, contains sites where production, testing and waste disposal activities resulted in metals contamination. Most of the metals found are confined to surface soils, and because they are not readily leachable, have not caused groundwater contamination,

A total of eight sites aregrouped under this SRU. Three of these sites are within the MFG Area and five are within the LAP Area, as shown in Table 4-1 and Figure 3. It should be noted that only certain subareas under each site are included in this SRU and not the entire site. Table 5-3 lists these subareas and the estimated volume of soil/sediment that needs to be remediated. Table 5-4 lists exceedances of Remedial Goals (RGs) for sites included in SRU2.

<u>Table 5-3: Sites and Subareas of SRU2 (*Metals in Soil*)</u>

Sites	Subareas	Volumes (CY)
L2	Soils near popping furnaces	4,440
L3	Soils east of demolition pits	10
	Fire Training Area	175
L5	Open storage area	1,070
L11	Soils in target area	445
L23A	Soils in pit	3,300
M3	Lead (and other metals) contaminated soil throughout the site	5,600
M4	Lead contaminated soil around the former lead azide lagoon	4,200
M12	Metal contaminated soil throughout the site	3,700
Total		**22,940**

5.1.2.1 Site L2 (Explosive Burning Grounds)

Site L2 is located in the west-central portion of the LAP Area, adjacent to Prairie Creek and Kemery Lake. The operational area covers approximately 5 acres and consists of six east-west pads, each approximately 650 feet long and 50 feet wide, on which explosives and associated wastes from Sites L7 to L10, L14, and L1, were burned. Three north-south burning pads were also present cast of this area in

1952 aerial photographs. These pads were subsequently reconfigured into one pad and the southern oil pits were constructed on the southern portion of these pads. Several parallel, elevated burning pads were constructed of gravel and fitted with electric igniters operated from a remote location. According to JOAAP personnel, spent carbon from the carbon units used in the TNT/Composition B melt-load processes was also incinerated on the burning pads. UXO, including fuzes and other items, have been identified to be present on the burning pads.

Three popping furnaces, where small ammunition was detonated, were located at the southwest corner of the site. During operations, metal waste from the furnaces was removed and sent to the Salvage Yard (Site L5). The Explosive Burning Grounds also contained three solvent and oil disposal pits (each less than 0.25 acre) located adjacent to the burning pads, which (according to JOAAP personnel) were occasionally used to burn waste oil. These pits were remediated in 1996 as part of a removal action conduct6d by the U.S. Army, and UXO were discovered to be buried in an area north of the burning pads. The UXO were disposed of properly as part of the removal action, although a complete UXO sweep was not performed and it is possible that additional UXO remain at the site in the vicinity of the removal action. Drainage features include two ditches, which flow from the northern portion of the burning pads to Kemery Lake, and a gully at the southwestern corner of the site, which receives runoff from the popping furnace area and southern portions of the site.

It is estimated that an area approximately 200 feet square surrounding and including the popping furnaces would require the remedial actions for arsenic, cadmium, and lead. Surface soil contaminated with arsenic, cadmium, and lead has been estimated to extend to a depth of 1 foot representing a volume of 1,480 CY. Additionally, arsenic contamination in subsurface soils around the popping furnaces is estimated to occur to a depth of 3 feet representing a volume of 2,960 CY.

Soils in the vicinity of the popping furnaces at Site L2 may be contaminated with RCRA characteristic hazardous wastes for cadmium (RCRA waste code D006) and lead (RCRA waste code D008).

5.1.2.2 Site L3 (Demolition Area)

Site L3 is located directly southwest of the Explosive Burning Grounds, Site L2. Covering approximately 50 acres, Site L3 is bounded to the west by Prairie Creek, to the south by an unnamed tributary to Prairie Creek, and to the east by Star Grove Cemetery. The principal operation conducted in this area was the open burning of combustible refuse and munitions crates. An air curtain destructor, which facilitates combustion while reducing particulate emissions, was constructed at the site but never used. In addition, uncontaminated solid waste and some potentially low-level explosives-contaminated solid waste from JOAAP operations were burned in this area. A 1-acre fire training area is also located at the site.

The burning area consisted of U- and L-shaped bermed areas and a burning cage, which is a concrete pad surrounded by a steel mesh cage used to contain the burning debris. During the RI-PH1, geophysical techniques used to clear UXO from work areas indicated the presence of buried metallic debris in and around the U- and L-shaped bermed areas. The fire training area consisted of a small depression enclosed by an earthen berm, which contained burning and fire training areas. The demolition pits (less than 1 acre) were heavily vegetated, which suggests there has been no recent activity in this area.

The volume of soil requiring a remedial action at the fire training pit is assumed to include the top 6 inches of surface soil over the entire fire training area (approximately 75 by 125 feet) and totals an estimated 175 CY. Soil in the area east of the demolition pits requiring a remedial action is estimated to include an area 25 SF to a depth of 6 inches of surface soil, totaling 10 CY. A total of 185 CY of soil is estimated to require a remedial action for lead.

No RCRA hazardous wastes are present at Site L3.

5.1.2.3 Site L5 (Salvage Yard)

Site L5 was used for salvage and open storage of miscellaneous materials from the installation. It is located in the northwestern corner of the LAP Area along Hoff Road. Metal waste from the popping furnaces at the Explosive Burning Grounds (Site L2) was reportedly sent to Site L5 when JOAAP was in operation. The area of contamination at the site include a 1,000 SF oil spill area near Building 26-3 and a 500-foot-long shallow ditch excavated in 1974 that is located south of the spill area. This ditch was used to store barrels of unknown substance(s). Other areas of contamination included several large piles of railroad ties (approximately 1 acre), and a large junk pile (less than 1 acre).

Metal contamination in the former open storage areas is primarily limited to surface soil. The concentration of lead in samples collected from the open storage area north of the junk pile, exceeds the RGs. An estimated 1,070 CY of soil is considered for a remedial action based on an affected surface area of 28,900 SF, and assuming contamination extends to a depth of 1 foot.

No RCRA hazardous wastes were identified in the open storage area at Site L5.

5.1.2.4 Site L11 (Test Site)

Site L11, covering approximately 33 acres, is located immediately south of Group 1 (Site L7). This area was developed to test the firing velocities and impact effectiveness of various munitions within a secured perimeter fence. Munitions were fired within this area into a downrange target area consisting of a coarse gravel detonation pad constructed over native soil.

According to JOAAP personnel, UXO may exist at the Test Site because during normal operations, approximately 10 ordnance per month failed to explode. UXO clearance activities performed during the PH1 field investigation did not detect any UXO, although numerous fragments were detected.

Arsenic was found at a level above itsRGs in all soil samples from the target area. The area affected by arsenic contamination, approximately 80 by 300 feet, is assumed to extend to a depth of 6 inches. The total volume is estimated to be 445 CY.

No RCRA hazardous wastes were identified at Site L11.

5.1.2.5 Site L23A (Disposal Pit)

Historic aerial photo-interpretation from 1946 identified a small (less than 0.5 acre) disposal pit located in the southwestern corner of Sites L23/L23A that is identified as Site L23A. It is not known what materials were placed in this pit; however, aerial photos from 1952 indicated that disposal activities had ceased.

Lead was detected in soil samples from the pit at concentrations exceeding its RGs. The volume of lead-contaminated soil is assumed to extend across the center of the disposal pit and the area north of the pit (approximately 100 feet north-south by 150 feet east-west) to a depth of 6 feet. The total affected volume of soil is estimated to be approximately 3,300 CY.

No RCRA hazardous wastes were identified at Site L23A.

5.1.2.6 Site M3 (Flashing Grounds)

Site M3 was described earlier in Section 5.1.1.9.

Approximately 150,000 of the 260,000 SF of topsoil within the 6-acre fenced area of M3 are estimated to contain lead contamination concentrations above the RGs. The vertical extent of' lead contamination is assumed to be limited to a maximum depth of 1 foot based upon the non-intrusive nature of flashing operations the volume of lead-contaminated soil in M3 exceeding the RGs is estimated to be 5,600 CY.

Soils at Site M3 may contain RCRA characteristic hazardous wastes for TCLP extractable lead (RCRA waste code D008) and TCLP extractable 2,4-DNT (RCRA waste code D030).

5.1.2.7 Site M4 (Lead Azide Area)

Site M4 (Lead Azide Area) is located in the west central part of the MFG Area and covers approximately 136 acres. Lead azide, a primary initiating explosive, was produced in M4 from the early 1940s through the Korean War and again during the Vietnam War from 1966 into early 1968.

The principal feature located in the western part of M4 was the Lead Azide Lagoon. The Lead Azide Lagoon was used as a settling basin to store wastewater treatment sludge from the manufacturing and formulation of lead-based initiating compound prior to neutralization and subsequent discharge to Grant Creek. Any remaining lagoon sludge is classified as K046 hazardous waste.

The Lead Azide Lagoon covered an area of approximately 2,000 SF. In 1982, the production facility in the central portion of M4 was demolished with the wreckage being burned within the Lead Azide Lagoon. At present, the only visible evidence of the lagoon is brick and concrete rubble in the surface soil.

Concentrations of lead greater than its clean up level were present in 14 of 20 soil samples analyzed from M4; lead was detected in an area covering approximately 47,500 SF, and extending to a depth of 3 feet. The volume of lead-contaminated soil in M4 exceeding the RGs is estimated to be 4,200 CY.

Soils at Site M4 may contain RCRA characteristic hazardous wastes for TCLP extractable lead (RCRA waste code D008) and RCRA listed hazardous wastes for lead wastewater treatment sludges (RCRA waste code K046).

5.1.2.8 Site M12 (Sellite Manufacturing Area)

M12 is located to the west of the TNT Ditch Complex in the northwestern portion of' the MFG Area. Sellite was manufactured for use in the purification of crude TNT. Sellite consists of a solution of sodium sulfite and sodium sulfate. M12 includes two sellite production units, a wastewater lagoon, and associated drainage ditches.

No data was collected that directly identifies the vertical extent of lead contamination in M12. Based on patterns of lead concentrations in samples collected in other areas within the MFG Area, the lead contamination in soils and sediments at the Sellite Manufacturing Area is presumed to be limited to a depth of 12 inches. The depth of contamination is based on high concentrations of sulfate throughout M12 and the insolubility of lead sulfate and other lead salts. The volume of lead-contaminated soil and sediment in M12 exceeding the RGs is estimated to be 3,700 CY and includes both sediment in the lagoon and soils in the ditches.

Soils at Site M12 may contain RCRA characteristic hazardous wastes for TCLP extractable lead (RCRA waste code D008).

Table 5-4 Exceedances of Remediation Goals (RGs as a Function of Land Use for Soils Found in SRU2

MIDEWIN TALLGRASS PRAIRIE AREAS (USDA)									
Site		**L2**	**L3**	**L5**	**L11**	**L23A**	**M3**	**M4**	**M12**
Metals	**RG (µg/g) USDA**	**Maximum Concentration Exceeding RecreationalRGs, (µg/g)**							
Arsenic	21	86			58		26	46	
Beryllium	2						3.76	2.19	3.48
Cadmium	3,000	5,800							
Lead	1,000	12,000	2,250	2,300		4,340	49,000	260,000	2,510
Contaminated Soil Volume (CY) Total	**22,940**	4,400	185	1,070	445	3,300	5,600	4,200	3,700

5.1.3 SRU3, Explosives and Metals in Soil

SRU3, Explosives and Metals in Soil, contains sites where production and disposal activities released both types of contaminants. Site L2, where explosives and munitions were burned, contains most of the identified contaminated soils, although sites M5 and M6 may also have substantial amounts. A total of four sites are grouped under this SRU. Two of these sites are within the LAP Area and two are within the MFG Area, as shown in Figure 3. It should be noted that only certain subareas under each site are included in this SRU and not the entire site. Table 5-5 lists the subareas and the volume of soil that needs to be remediated. Table 5-6 lists exceedances of Remedial Goals (RGs) for sites included in SRU3.

Table 5-5: Sites and Subareas of SRU3 *(Explosives and Metals in Soil)*

Sites	Subareas	Volumes (CY)
L2	Burning Pads	16,350
L3	Bermed area	1,070
M5	Lead (and other metals) contaminated soil throughout the whole area of the site	3,700
M6	Soil in the TNT Ditch	12,000
Total		**33,120**

5.1.3.1 Site L2 (Explosive Burning Grounds)

Site L2 was described in Section 5.1.2. 1.

Analytical results of soil samples collected at site L2 indicate that the majority of the burning pads area (approximately 206,500 SF) is contaminated with 2,6-DNT, RDX, arsenic and lead above RGs. The total volume of soil at this site that exceeds RGs for explosives and lead is estimated to be 16,350 CY.

No RCRA hazardous wastes were identified in and around the burning pads at Site L2.

5.1.3.2 Site L3 (Demolition Area)

Site L3 was described in Section 5.1.2.2.

Results of sampling of site L3 indicated contamination of RDX and lead that exceed RGs in the western portion of the bermed area with an approximate surface area of 170 SF from the western edge. Since samples from 2.5 feet in depth did not exceed RGs for explosives or metals, soil contamination over the 170-foot square area has been assumed to extend 1 foot below grade. The volunic of explosives and metals-contaminated soil within the bermed area of site L3 is estimated to be 1,070 CY. In addition, UXO were identified in this area.

No RCRA hazardous wastes were identified at Site L3.

Table 5-6 Execedanecs of Remediation Goals (RGs) as a Function of Land Use for Soils Found in SRU3

MIDEWIN TALLGRASS PRAIRIE AREAS (USDA)				INDUSTRIAL PARK AREAS		
Sites		**L2**	**L3**	**Sites**	**M5**	**M6**
Maximum Concentration Exceeding Industrial or Recreational RGs (µg/g)						
	Recreational RG (µg/g) USDA			**Industrial RG (µg/g)**		
Explosives						
1,3,5-TNB	180		300	100		
2,4,6-TNT	290		1,100	190	390	19,000
2,4-DNT	13		17	8.4	9.76	2,700
2,6-DNT	13	15.4		8.4	11.8	
RDX	78	2,400		52		
Tetryl	7,400			4,100	170,000	
Metals						
Arsenic	21	96		21		22
Beryllium	2			2	2.08	2.22
Lead	1,000	2,050	1,120	1,000	7,300	2,300
Contaminated Soil Volume (CY),Total	**33,120**	16,350	1,070		3,700	12,000

5.1.3.3 Site MS (Tetryl Production Area)
M5 was described in Section 5.1.1.10.

Results of sampling of site M5 indicated contamination of Tetryl, 2,4,6-TNT, 2,4-DNT, 2,6-DNT, lead and beryllium that exceed RGs. The volume of explosives and metals contaminated soil throughout the whole area of the site is 3,700 CY.

Soils at Site M5 may contain RCRA characteristic hazardous wastes for TCLP extractable lead (RCRA waste code D008).

5.1.3.4 Site M6 (TNT Ditch Complex)
Site M6 was described in Section 5.1.1.11.

Results of sampling of site M6 indicated contamination of 2,4,6-TNT, 2,4-DNT, lead, arsenic, and beryllium that exceed RGs. The volume of explosives and metals contaminated soil in the TNT Ditch is 12,000 CY.

Soils at Site M6 may contain RCRA characteristic hazardous wastes for TCLP extractable lead (RCRA waste code D008) and TCLP extractable 2,4-DNT (RCRA waste code D030).

5.1.4 SRU4 PCBs in Soil

SRU4, PCBs in Soil, consists of soils around transformers located in sites L7 to L10, and of soils beneath a junk pile found at L5. Leakage and spills from the transformers caused the contamination.

A total of seven sites are grouped under this SRU. All of these sites are within the LAP Area, as shown in Figure 3. It should be noted that only certain subareas under each site are included in this SRU and not the entire site. Table 5-7 lists the subareas and the volume of soil/sediment that need to be remediated. Table 5-8 lists exceedances of RGs for sites included in SRU4.

5.1.4.1 Site L1 (Group 61)

Site L1 was described in Section 5.1.1.1.

Two transformers removed in August 1990 from an area east of Building 61-4 were suspected to have leaked oil containing PCBs onto site soil; the spill was subsequently cleaned up. However, based on the subsurface detection of PCB 1260, a surface area of 20 by 35 feet surrounding the northern pole is contaminated with PCBs above the RGs to a depth of 2 feet. Also, an area 10 feet square surrounding sample location SC5 is contaminated with an additional 1.5 feet (3.5 feet below grade). A total volume of approximately 60 CY of soil is estimated to be contaminated above clean up levels for surface and subsurface soils.

No RCRA hazardous wastes were identified at Site Ll. However, the soils contain PCBs, which are regulated as TSCA hazardous substances.

Table 5-7: Sites and Subareas of SRU4 *(PCBs in Soil)*

Sites	**Subareas**	**Volumes (CY)**
Ll	Soil near transformer pole east of building 61-4	60
L5	Junk pile (includes metals)	1,965
L7	Soils around transformer pads	338
L8	Soils around transformer pads	102
L9	Soils around transformer pads	317
L10	Soils around transformer pads	534
L17	Sediment in drainage ditch	100
Total		**3,416**

5.1.4.2 Site L5 (Salvage Yard)

Site L5 was described in Section 5.1.2.3.

The junk pile at Site L5 occupies less than 1 acre in the southeast comer of the site. This area contains concentrations of metals (arsenic and lead), PCBs, and TPH in soil at levels above clean up levels for these constituents. The area of affected soils within and around the junk pile contaminated by metals, PCBs, and TPH measures approximately 140 feet wide (north-south) and 200 feet long (east-west) totaling 28,000 SF and includes a perimeter extending 25 feet out from the edge of the pile. The volume of contaminated soil is estimated to be 1,040 CY, based on a depth of contamination of 1 foot throughout the area. In addition, subsurface soils are assumed to be contaminated with PCBs to a depth of 5 feet within the eastern end of the pile (an estimated area of 50 feet by 50 feet) giving additional volume of 370 CY. Of additional concern are items within the junk pile, which include scrap metal, pole transformers, empty sodium hydroxide drums, refrigerators, and water heaters. The volume of this material is estimated to be 555 CY. The total volume of contaminated soil at this site is estimated to be 1,965 CY.

RCRA hazardous wastes may be present in the area of the Junk Pile at Site L5 in the form of TCLP extractable lead (RCRA waste code D008) and TCLP extractable cadmium (RCRA waste code D006). The soils also contain PCBs, which are regulated as TSCA hazardous substances.

5.1.4.3 Site L 7 (Group 1)
Site L7 was described in Section 5.1.1.2.

Six transformers, potentially containing askarel oil with PCBs, are also located at Site L7. Based on the sampling results, the levels of PCBs in surface soil surrounding all six Site L7 transformers exceed the RGs for PCBs in surface soil. PCB contamination has been assumed to extend to a maximum depth of 1 foot within most of the contaminated area based on the relatively low levels of PCBs present in samples collected 15 feet from the transformer pads. Around the immediate edge (5 to 10 feet laterally) of the transformer pad where PCB levels are highest in surface soil, PCB contamination above the clean up levels has been conservatively assumed to extend to a depth of 2.5 feet. The total volume of contaminated soil is estimated to be 338 CY.

No RCRA hazardous wastes were identified at Site L7. However, the soils contain PCBs, which are regulated as TSCA hazardous substances.

5.1.4.4 Site L8 (Group2)
Site L8 was described in Section 5.1.1.3.

Six transformers are located at Site L8. Based on sampling results, the levels of' PCBs in surface soil surrounding all six Site L8 transformers exceed the RGs for PCBs in surface soil. PCB contamination has been assumed to extend to a maximum depth of 1 foot within contaminated areas near the transformer pads, based on the relatively low levels of PCBs present in the samples. Approximately 94 CY of PCB-contaminated soil are affected locally around six site L8 transformers. The remedial action will also require the demolition of the six transformer pads, totaling 7.5 CY of concrete debris. The total volume of contaminated soil at this site is estimated to be 102 CY.

No RCRA hazardous wastes were identified at Site L8. However, the soils contain PCBs, which are regulated as TSCA hazardous substances.

5.1.4.5 Site L9 (Group 3)
Site L9 was described in Section 5.1.1.4.

Six transformers are located on-site. Because PCBs were detected around all transformer pads at sites L7, L8, and L10, which had similar operations to site L9, it has been assumed that soils around the site L9 pads also contain PCBs. An estimated volume of 310 CY has been assumed. This volume was calculated by averaging the estimated volumes for sites L7, L8, and L10. The confirmation sampling will be conducted during the Remedial Design phase. The assumed PCB contamination will be confirmed during the remedial design phase. The six transformer pads will also require remedial actions for their removal (7.5 CY). The total volume of contaminated soil is estimated to be 317 CY.

No RCRA hazardous wastes were identified at Site L9. However, the soils may contain PCBs, which are regulated as TSCA hazardous substances.

5.1.4.6 Site L10 (Group 3A)

Site L10 was described in Section 5.1.1.5.

Six transformers are also located on-site. Around 1987, one of the transformers in the northeastern part of the site reportedly leaked approximately 4 gallons of PCB-containing oil (with concentrations of 41,000 ppm PCB) onto a concrete pad. “Oil dry” was placed on the concrete to remove the oil, and the pad was wiped with cloth soaked in LIX, a solvent containing volatile organic compounds (VOCs).

Based on sampling results, the levels of PCBs in surface soil surrounding all six Site L10 transformers exceed the RGs for PCBs in surface soil. Approximately 505 CY of PCB-contaminated soils are affected locally around six Site L10 transformers, The remediation of this site will require the demolition of the six transformer pads, totaling 7.5 CY of concrete debris and approximately 50 feet of asphalt road, totaling 21 CY. The total volume of contaminated soil is estimated to be 534 CY.

No RCRA hazardous wastes were identified at Site L10. However, the soils contain PCBs, which are regulated as TSCA hazardous substances.

Table 5-8 Exceedances of Remediation Goals (RGs) as a Function of Land Use For Soils Found in SRU4

MIDEWIN TALLGRASS PRAIRIE AREAS (USDA)								INDUSTRIAL PARK AREAS	
Sites		**L1**	**L5**	**L7**	**L8**	**L9**	**L10**	**Sites**	**L17**
Maximum Concentrations Exceeding Recreational and Industrial RGs (µg/g)									
	RG (µg/g) USDA							**RG (µg/g) Ind. Park**	
Metals									
Arsenic	21		31					21	
Lead	1,000		4,700					1,000	
Pest/PCBs									
PCB	1	25	73,400	532	40	*Note (1)*	16,000	1	1,640
Special Parameters									
THP	2,500		2,590					2,500	
Contaminated Soil Volume (CY),Total	**3,416**	60	1,965	338	102	317	534		100

Notes: (1) Confirmation sampling at Site L9 will be conducted during the RD phase,.

5.1.4.7 Site Ll7 (Group 7)

Site L17, a 90-acre site, is located in the southwestern comer of the LAP Area. It was initially constructed for the production of boosters for munitions. After termination of loading operations in 1945, Site Ll 7 was used for repacking of lead azide. A sump is located at the southern end of Building 7-4; and a terra cotta flume drains to the west from the sump.

PCBs, primarily localized in drainage ditch soils near a sewer outfall, are present to a depth of 5 feet. Additionally, low concentrations of PCBs in surface soil/sediment extend at least 150 feet downstream. The volume of soil/sediment containing PCBs in this ditch is estimated assuming that contamination is 5 feet deep in a 30-foot section at the head of the ditch, and 1 foot deep for another 100 feet. The ditch is approximately 10 feet wide, and it is assumed that this width is similar to the lateral extent of PCB contamination. The total volume of soil contaminated at concentrations above RGs is estimated to be 100 CY.

No RCRA hazardous wastes were identified at Site Ll1. However, the soils contain PCBs, which are regulated as TSCA hazardous substances.

5.1.5 SRU5, Organics in Soil

SRU5, Organics in Soil, consists of sites L1 (Group 61) and L5 (Salvage Yard) where petroleum products were spilled. Both of these sites are within the LAP Area, as shown in Figure 3. It should be noted that only certain subareas under each site are included in this SRU and not the entire site. Table 5-9 lists the subareas and the volume of soil/sediment that needs to be remediated. Table 5-10 lists exceedances of RGs for sites included in SRU5.

Table 5-9: Sites and Subareas of SRU5 *(Organics in Soil)*

Sites	**Subareas**	**Volumes (CY)**
Ll	Soil near above-ground storage tanks (ASTs) at Building 6 1 -1 and 61-2	1,275
L5	Oil stain area	30
	Drainage ditch	555
	Soil below railroad ties	550
Total		**2,410**

5.1.5.1 Site Ll (Group 61)

Site L1 was described in Section 5.1.1.1.

Field reconnaissance identified petroleum-stained soils near aboveground storage tank (AST) locations west of Building 61-1 and north of Building 61-2. In the vicinity of the AST location at Building 61-1, samples were collected at the surface and at depths of 2.5 and 5 feet. TPH was detected in all samples at concentrations above the RGs. The surface area contaminated by TPH is estimated to be 2,500 SF and contamination is assumed to extend to a depth of 10 feet. This volume of soil is estimated to be 925 CY. In the vicinity of the ASTs located at Building 61-2, soils below the ASTs within the surrounding earthen berm are heavily saturated with petroleum products and presumably are contaminated with TPH above the cleanup levels. The hydrocarbon-stained soils are limited to the area within the earthen berm surrounding the tanks, which is approximately 900 SF based on field measurements. Therefore, the volume of soil north of Building 61-2 is estimated to be 350 CY assuming contamination extends to a depth of approximately 10 feet below grade.

In summary, a total volume of 1,275 CY of soil is contaminated above the TPH RGs at the two AST locations of site L1

No RCRA hazardous wastes were identified at Site L1.

5.1.5.2 Site L5 (Salvage Yard)
Site L5 was described in Section 5.1.2.3.

The 500-foot long shallow drainage ditch is an area at site L5 that contains concentrations of metals (beryllium, lead, and arsenic) and organics (TPH) in soil at levels above clean up levels for these constituents. The volume of contaminated soil in the ditch area is estimated to be 555 CY, assuming soils in an area 25 feet wide and 500 feet long are contaminated to a depth of 1 foot and, an area 25 feet by 50 feet, are contaminated to 2 feet in depth.

The former oil spill area adjacent to Building 26-3 contains surface soils that exceed the TPH RGs. The volume of TPH-contaminated soil in the oil spill area of site L5 is estimated to be 30 CY and is limited to soils 1 foot in depth between Buildings 26-3 and 26-4.

The large piles of railroad ties are located over approximately 1 acre in the south-central section of site L5. Soil samples collected within this area identified concentrations of benzo(a)pyrene above the RGs. Based on the available data, the extent of organics contamination above RGs is assumed to be limited to the western half of the area of the piles of railroad ties (an area of 300 feet by 100 feet) to a depth of 6 inches. This area represents a volume of approximately 550 CY.

The total volume of soil contaminated with organics at this site is estimated to be 1,135 CY. The contaminants of concern found at Site L5 also include arsenic, beryllium, lead, and benzo(a)pyrene. The maximum concentrations of these compounds exceeded the RGs levels.

No RCRA hazardous wastes were identified in the ditch and oil stain areas at Site L5.

Table 5-10 Exceedances of Remediation Goals (Rgs as a Function of Land Use for Soils Found in SRU5

MIDEWIN TALLGRASS PRAIRIE AREAS (USDA)			
Site		**L1**	**L5**
	RG (µg/g) USDA	**Maximum Concentration Exceeding Recreational RGs (µg/g)**	
Metals			
Arsenic	21		50
Beryllium	2		2.7
Lead	1,000		1,220
Semivolatiles			
Benzo(a)pyrene	1.2		1.5
Special Parameters			
TPHs	2,500	111,000	10,000
Contaminated Soil (CY) Total	**Volume 2,410**	1,275	1,135

5.1.6 SRU6, Landfills

SRU6 consists of six sites used for waste disposal during production and operation activities. Site L3 is a demolition area that includes large quantities of buried waste materials in berms along Prairie Creek as well as other features described earlier. Site L4 is an existing disposal area containing construction debris. Sites M1 and M9 are constructed landfills that contain red water ash from the incineration of wastewater (red water) generated during TNT and DNT production. Both are classified as RCRA hazardous waste sites that must be remediated. Site M11 is a large 70-acre former gravel pit that was filled with construction debris and other materials. Site M13 contains an 8-acre former gravel pit that was filled with a variety of non-hazardous industrial debris and wastes. Remediation is required at all the above waste disposal sites to comply with current landfill regulations, to prevent human exposure to these wastes, and to prevent potential migration of contaminants from these areas into the groundwater.

A total of six sites are grouped under this SRU. Four of these sites are within the MFG Area and two are within the LAP Area, as shown in Figure 3. It should be noted that certain subareas under each site are included in this SRU and not the entire site. Table 5-11 lists the subareas, the estimated areas that the landfills cover, and the estimated volume of soil that needs to be remediated. Table 5-12 lists exceedances of RGs for sites included in SRU6.

5.1.6.1 Site L3 (Demolition Area)
Site L3 was described in Section 5.1.2.2.

The berms located along Prairie Creek are contaminated with lead, chlordane, 2,6-DNT and phosphate above the RGs for these constituents. The berms are present within an area measuring approximately 800 feet along Prairie Creek and 300 feet wide in the northwest portion of site L3. The entire area between Prairie Creek and the easternmost access road is presumed to be filled with metallic debris and other wastes including UXO.

The extent of contamination in the berms along Prairie Creek appears to be related to the presence of fill material. Several assumptions were made to calculate fill volumes. Average berm heights are estimated to be 8 feet in the northern berms and 3 feet in the southern berms. The average depth of fill is estimated at 3 feet below ground surface in the northern area and 2 feet below ground surface in the southern area. The fill is believed to be deeper closer to Prairie Creek greater than 10 feet and pinches out east of the burning cage. The estimated volume of the material is 35,000 CY.

Site L3 may contain unexploded ordnance which are classified as RCRA characteristic wastes (RCRA waste code D003) because of their reactivity

Table 5-11: Sites and Subareas of SRU6 *(Landfills)*

Sites	Subareas	Area (Acres)	Volumes (CY)
L3	Burning areas (berms) along Prairie Creek	7.5	35,000
L4	Landfill	6.5	37,000
M1	The southern ash pile	8.5	205,200
M9	The northern ash pile	6.5	124,000
M11	Materials in the Landfill Area	78	66,600
M13	Materials in former disposal area	13	222,000
Total		**120**	**690,700**

5.1.6.2 Site L4 (Landfill Area)

Site L4 is located southwest of the Demolition Area (Site L3), on the northern side of Prairie Creek. Two former extraction pits excavated to bedrock are located in this area. The western extraction pit is partially filled with construction waste and sanitary sewage, and the eastern pit has been flooded by Prairie Creek.

Operating from the early 1940s (World War II) until the late 1960s, the landfill associated with the western pit reportedly accepted various types of construction debris. In addition, 5-gallon pails containing unknown substances were reportedly disposed of in the landfill. The final cover, reportedly compacted clean fill, was placed in the 1970s.

Although this area is currently completely vegetated, several small sinkholes were observed where the fill materials had collapsed. Based on the depth to bedrock in the area, the fill is not anticipated to be more than 15 feet deep and may extend eastward to a small drainage ditch. No fill was identified in the southwestern portion of the site, and the exposed bedrock south of the fill area defines the southern boundary. Based on the real extent of the fill and estimated depth, it is calculated that the landfill contains 37,000 CY of waste materials.

No RCRA hazardous waste was identified at Site L4.

5.1.6.3 Site M1 (Southern Ash Pile)

Site M1 is comprised of approximately 68 acres located in the southwestern part of the MFG Area. The Southern Ash Pile was used from 1965 through 1974 as a landfill for ash residues generated from the incineration of wastewater produced in the TNT manufacturing processes. The "red water ash" in the Southern Ash Pile is derived from K047-listed hazardous wastes. IEPA has notified the Army, by letter of July 24, 1998, that since the ash residues at M1 no longer exhibit the characteristic of reactivity (for which they were listed), they are not hazardous wastes under the regulation at 35 IAC 721.103(a)(2)(C).

The ash pile, measuring 800 feet by 450 feet, covers approximately 8 acres. The ash pile is 10 to 15 feet high and is estimated to contain 205,200 cubic yards of material. Upon closure. the ash pile was originally covered with polyvinyl chloride (PVC) barriers, 12 inches of fill, and 6 inches of topsoil. However, as a result of erosion, the Southern Ash Pile was recapped in 1985 with an additional 12 inches of clay and 6 inches of topsoil. Due to continuing erosion, additional repairs to the ash pile cap were performed in 1993, and a temporary geosynthetic liner was installed in 1996 as part of a removal action conducted by the U.S. Army.

No RCRA hazardous waste was identified at Site M1.

5.1.6.4 Site M9 (Northern Ash Pile)

Site M9 is comprised of approximately 20 acres located at the top of an escarpment in the north-central part of the MFG Area. The Northern Ash Pile was constructed during 1966 and 1967 as a landfill for ash residues from the incineration of TNT manufacturing wastes. The red water ash in the Northern Ash Pile is derived from K047-listed hazardous wastes. IEPA has notified the Army, by letter of July 24, 1998, that since the ash residues at M9 no longer exhibit the characteristic of reactivity (for which they were listed), they are hazardous wastes under the regulation at 35 IAC 721.103(a)(2)(C).

The ash pile measures more than 625 feet by 600 feet and covers approximately 5 acres. The ash pile is 10 to 15 feet high with a domed top and steep sides. The Northern Ash Pile is estimated to contain 124,000 cubic yards of material. Upon closure, the ash pile was originally covered with PVC barriers, 12 inches of fill, and 6 inches of topsoil. However, as a result of erosion, the Northern Ash Pile was recapped in 1985 with an additional 12 inches of clay and 6 inches of topsoil. Evidence of leaching from the eastern, southern and western edges of the Northern Ash Pile has been observed during site reconnaissance in the form of stressed vegetation. The presence of several collapsed features across the ash pile have been documented, some of which have breached the clay cap and exposed ash material. The cap was repaired again by the U.S. Army in 1993.

No RCRA hazardous waste was identified at Site M9.

5.1.6.5 Site M11 (Landfill)

Site M11 is located to the east and south of the Explosive Burning Ground (M2) and covers approximately 133 acres. While initially used as a source of gravel, this area was operated between 1952 and 1978 as an uncontrolled dump. M11 is divided into two sections by School House Road. The Landfill is located on a ridge estimated to be 800 feet wide by 5,600 feet long and oriented northeast to southwest. The ridge rises 10 to 15 feet above the surrounding low plain.

A variety of waste materials are contained in the landfill. The materials include asbestos, insulation, and construction rubble. Numerous 55-gallon drums have also been identified, other debris includes creosote-treated wood, paint cans and scrap metal. Similar materials are believed to be buried in the M11 gravel pit excavations. An area covered with asphalt tar is located in the central part of the southern portion of M11. A gravel pile, covered with a white residue, is also presentin this part of the Landfill. Samples of the waste detected concentrations of lead at levels exceeding the TCLP limits, indicating that some of the wastes present would be classified as RCRA hazardous wastes. The estimated volume of the material is 66,600 CY.

RCRA characteristic hazardous wastes may be present at Site M11 in the form of TCLP-extractable lead (RCRA waste code D008).

Table 5-12 Exceedances of Remediation Goals (RGs) as a Function of Land Use for Soils Found in SRU6

MIDEWIN TALLGRASS PRAIRIE AREA (USDA)						**INDUSTRIAL PARK AREAS**		
Sites		**L3**	**L4**	**M1**	**M11**	**Sites**	**M9**	**M13**
Maximum Concentration Exceeding Recreational and Industrial RGs (µg/g)								
	Recreational RG (µg/g) USDA					**Industrial RG (µg/g)**		
Explosives								
2,4-DNT	13					8.4	10.9	
2,6-DNT	13	24				8.4		
Metals								
Arsenic	21				30	21	22	
Lead	1,000	2,740			3,380	1,000		
Pest/PCBs								
Chlordane	6.6	6.9				4.4		
Semivolatiles								
Benzo(a)pyrene	1.2					0.78		
Special Parameters								
Phosphate	456	2,000	880			456		
Landfill Soil Volume (CY), Total	**623,200**	35,000	37,000	205,200	N/A		124,000	222,000
Landfill Area (acres), Total	**120**	7.5	6.5	8.5	78		6.5	13

5.1.6.6 Site M13 (Gravel Pit)
Site M13 is located in the central portion of the MFG Area to the north of the Tetryl Production Area, to the east of the TNT Ditch Complex, and to the west of Acid Area 1. The Gravel Pits cover approximately 106 acres.

Four potential disposal areas have been identified within M13. Each of the disposal areas in M13 has an area of less than 12 acres. Plant records and aerial photographs indicate that landfill activities at the Northern Gravel Pit began in 1966 and ceased in 1984. The topography in the vicinity of the Northern Gravel Pit is flat. The Northern Gravel Pit contains scrap metal, creosote-treated railroad ties and telephone poles, and a variety of construction and office debris. None of the other pits were identified as containing wastes posing potential threats to human health or the environment.

Site related soil contaminants include beryllium, lead, and benzo(a)pyrene. The material in the former disposal area requiring remedial action is estimated to be 222,000 CY.

No RCRA hazardous wastes were identified at Site M 13.

5.1.7 SRU7, Sulfur
SRU7, Sulfur, consists of areas where raw sulfur lies on the ground surface at sites M8 and M12 and maybe impacting the environment. Raw sulfur was used to produce sulfuric acid and other chemicals used in the production of explosives. The sulfur is spread over wide areas on the ground surface. The removal of sulfur is not regulated under the CERCLA.

A total of two sites are grouped under this SRU. Both of these sites are within the MFG Area, as shown in Figure 3. It should be noted that only certain subareas under each site are included in this SRU and not the entire site. Table 5-13 lists the subareas and the volume of raw sulfur that needs to be remediated. Table 5-14 lists exceedances of Remedial Goals (RGs) for sites included in SRU7.

5.1.7.1 Site M8 (Acid Manufacturing Area)
Site M8 covers an area of approximately 304 acres in the central portion of the MFG Area. The shape of M8 is an inverted “L” oriented lengthwise from north to south. M8 contains four areas in which nitric and sulfuric acids were produced and combined into various strength “mixes” for use in the manufacturing of DNT, TNT, and tetryl.

Acid Area 3 is located in the northeast corner of M8. The production of Oleum, strong nitric acid, and other acids used in the production of explosives was the principal activity in Acid Area 3. Acid Area 3 contains the Oleum Plant, the Northern Ammonia Oxidation Plant (AOP), and the Northern Acid Area.

The Oleum Plant is located in the northern portion of Acid Area 3. The southern half of the Oleum Plant consists of concrete and brick pads for the receiving and storage of bulk sulfur. Raw sulfur is readily apparent throughout this area and along the southern railroad spur. The areal extent of raw sulfur contamination in the Oleum Plant is estimated to be 36,000square feet. The volume of raw sulfur in the Oleum Plant is estimated to be 6,100 CY.

No RCRA hazardous wastes were identified at Site M8.

Table 5-13: Sites and Subareas of SRU7 (Sulfur)

Sites	Subareas	Volumes (CY)
M8	Sulfur present throughout the Oleum Plant	6,100
M12	Sulfur in the wetland area and drainage ditch immediately south of the lagoon	1,400
Total		7,500

5.1.7.2 Site M12 (Sellite Manufacturing Area)

Site M12 was described in Section 5.1.2.8.

The environmental impacts of raw sulfur on vegetation are observed at the wastewater outfall located to the north of the sellite manufacturing facility. The absence of vegetation in and immediately adjacent to surface deposits of sulfur is also notedin the former lagoon located in the northeast portion of M12. The volume of sulfate-contaminated soil is estimated to be 1,400 CY.

No RCRA hazardous wastes were identified at Site M12.

Table 5-14 Exceedances of Remediation Goals (Rgs) as a Function of Land Use for Soils Found in SRU7

MIDEWIN TALLGRASS PRAIRIE AREAS (USDA)		INDUSTRIAL PARK AREAS	
Sites	**M12**	**Sites**	**M8**
Maximum Concentration Exceeding Recreational and Industrial RGs*(µg/g)*			
Recreational RG (µg/g)		**Industrial RG (µg/g)**	
Special Parameters Sulfur n/a	Raw sulfur considered a potential health hazard	n/a	Raw sulfur considered a potential health hazard
Contaminated Soil Volume (CY), Total 7,500	1,400		6,100

5.1.8 SOU No Further Action Sites

Overall, 53 sites plus three subareas were identified under the CERCLA program at JOAAP. Twenty-eight (28) sites plus one subarea suspected as having contaminated soil were investigated during the RI/FS and determined to have either no historical evidence suggesting contamination potential, no contamination, or contaminant concentrations that do not pose a threat to human health or the environment. Soils at these sites exhibit no characteristic of hazardous wastes. IEPA and USEPA agree that, under CERCLA requirements, no further cleanup actions are required for these sites. These sites, and the reason for their designation for no further action, are presented in further detail in Section 6.6.

5.2 Groundwater OU

5.2.1 GRU1, Explosives – LAP Area

GRUI, Explosives in Groundwater, is entirely in the LAP Area and consists of separate plumes emanating from sources in Sites L1, L2, L3, and L14 (Figure 4). Explosives are the only contaminants found in these plumes that could pose a risk to human health or the environment. The GRU1 plumes are within the glacial drift aquifer for all sites. The plumes extend into the upper bedrock aquifer for Sites Ll, L2 and L3 but not for Site L14 (Table 5-16). It should be noted that the plumes under each site are included in this GRU and not necessarily the entire site. Table 5-17 lists exceedances of Remedial Goals (RGs) for sites included in GRU1.

Table 5-15: Sites Overlying GRU1 (Explosives in Groundwater –LAP Area)

Sites	Subareas	Volumes (MG)
L1	Groundwater related to the ridge-and-furrow area	69
L2	Groundwater downgradient of burning pad area	4
L3	Groundwater downgradient of burning cage	2
	Groundwater downgradient of bermed area	10
L14	Groundwater downgradient of sumps of Bldg. 4-5	2
Total		**87**

5.2.1.1 Site L1 (Group 61)

Site L I was described in Section 5.1.1.1.

The contaminants detected at elevated levels in groundwater at Site Ll are explosives (1,3,5-TNT, 2,6-DNT, and RDX). Groundwater contamination at Site Ll originates as a result of contaminant migration from the ridge-and-furrow area, with the plume extending southward toward MW172 and MW173. Given the relatively high concentrations of explosives in soil on-site, contaminant migration from soil to groundwater may be occurring, although the majority of the groundwater contamination is attributed to the infiltration of discharged liquids.

No RCRA hazardous wastes were identified in the groundwater at Site L1.

5.2.1.2 Site L2 (Explosives Burning Grounds)

Site L2 was described in Section 5.1.2.1.

Waste disposal activities at this site have resulted in a groundwaterplume containing RDX that appears to emanate from the north/northeastern portion of the burning pad area.

No RCRA hazardous wastes were identified in the groundwater at Site L2.

5.2.1.3 Site L3 (Demolition Area)

Site L3 was described in Section 5.1.2.2.

There are two separate explosives-contaminated groundwater plumes that are of concern for site L3, groundwater downgradient of the burning cage and groundwater downgradient of the central bermed area. The RI investigations indicate that these two groundwater plumes are not connected. Groundwater downgradient of the burning cage (MW410) was found to contain only RDX, at a concentration 222.2 µg/L.

The source of this contamination appears to be contaminated materials buried in the berms along the creek. RDX was detected in bedrock well MW412, located downgradient of the bermed area, at a concentration 77.9 µg/L.

No RCRA hazardous wastes were identified in the groundwater at Site L3.

Table 5-16 Exceedances of Remediation Goals (Rgs) as a Function of Land Use for Groundwater Found in GRU1

MIDEWIN TALLGRASS PRAIRIE AREAS (USDA)					
Site		**L1**	**L2**	**L3**	**L14**
Explosives	**RG (µg/l) USDA**	**Maximum Concentration Exceeding Risk Based, Park Exployee RGs (µg/l)**			
1,3,5-TNB	5.1	1,300			
2,4,6-TNT	9.5	1,900			
2,4-DNT	0.42	2.01			
2,6-DNT	0.42	8.54			
RDX	2.6	56.50	640	77.90	840
Affected Aquifers		GD,SB	GD,SB	GD,SB	GD,SB
Contaminated Volume (MG), Total	**87**	69	4	12	2

Key: GD glacial drift, shallow aquifer
SB shallow bedrock aquifer

5.2.1.4 Site L14 (Group4)

Site L 14 was described in Section 5.1.1.6.

RDX is the primary explosive detected in groundwater at Site L14. The source of this contamination appears to be overflows and leaks from the sump north of Building 4-5.

No RCRA hazardous wastes were identified in the groundwater at Site L14.

5.2.2 GRU2, Explosives and Other Contaminants – MFG Area

GRU2, Explosives and Other Contaminants in Groundwater, is entirely in the MFG Area and consists of plumes emanating from sources in Sites M1, M5, M6, and M7 (Figure 4). These plumes also extend beneath portions of siteM8 and M13 although there are no suspected sources in those areas. Explosives were found in the overburden and upper bedrock aquifer in the plumes emanating from the sources. Various metals were found in groundwater under Site M1. One volatile organic compound (VOC), Tetrachloroethene (PCE), was found in a sample taken under SiteM8 in 1995 (Table 5-18). Table 5-19 lists exceedances of RGs for sites included in GRU2.

5.2.2.1 Site M1 (Southern Ash Pile)

Site M1 was described in Section 5.1.6.3.

The source of the groundwater contamination appears to be the ash placed at this site. A positive detection for 2,6-DNT was also found in the sample analyzed from MW231(2.72 µg/L). Antimony was detected above the RGs levels in at least one sample from this study area (31 µg/L). No RCRA hazardous wastes were identified in the groundwater at Site M1.

Table 5-17 Sites Overlying GRU 2 (Explosives and Other contaminants in Groundwater – MFG Area)

Sites	Subareas	Volumes (MG)
M1	Southern Ash Pile (explosives and antimony)	62
M5	Tetryl Production Area (explosives)	96
M6	TNT Ditch Complex (explosives and PCE)	96
M7	Red Water Area (explosives and antimony)	96
M8	Acid Manufacturing Area (explosives and PCE)	96
M13	Gravel Pits (explosives, cadmium and antimony)	96
Total		**542**

5.2.2.2 Site M5 (Tetryl Production Area)
Site M5 was described in Section 5.1.1.10.

Two samples from the MW207 contained 2,6-DNT and 2,4,6-TNTat the concentrations 5.53 µg/L and 16.7 µg/L, respectively. MW207 is located in the northern central part of Site M5, near junction of the East-West Ditch and the Tetryl Ditch. Wastewaters discharged into those ditches are the suspected source of the contamination. In addition toexplosive contamination, iron was detected (42,000 µg/1) above the established background levels.

No RCRA hazardous wastes were identified in the groundwater at Site M5.

5.2.2.3 Site M6 (TNT Ditch Complex)
Site M6 was described in Section 5.1.1.11.

Seven explosives (RDX, 2,4-DNT, 2,6-DNT, NB, 2-NT, 1,3,5-TNB, 2,4,6-TNT) were detected with concentrations above the RGs in groundwater samples from this site.

The obvious source of explosives in groundwater is through percolation from the TNT Ditch. Other sources are soil-impacted areas associated with the various production lines and the wastewater discharges into various sewer lines. These sources probably continue to release explosives to the groundwater. In addition to explosives, Tetrachloroethene (PCE) was detected (150 µg/L) in one sample above the established Class II Illinois Groundwater Standard and appears to be derived from a release in the former shop area of Site M6. Cadmium was detected in a sample taken from MW123 in 1982 at a concentration (162 µg/L) higher than the Class II Illinois Groundwater Standard. it is uncertain if this detection is representative of actual site conditions, which will be further assessed during the remedial design.

No RCRA hazardous wastes were identified in the groundwater at Site M6.

5.2.2.4 Site M7 (Red Water Area)
Site M7 was described in Section 5.1.1.12.

Four explosives (RDX, 2,4-DNT, 2,6-DNT, 2,4,6-TNT) were detected in groundwater samples from this site. The suspected source of the groundwater contamination in this area is release of wastewaters containing explosives compounds.

No RCRA hazardous wastes were identified in the groundwater at Site M7.

Table 5-18 Exceedances of Remediation Goals (Rgs) as a Function of Land Use for Groundwater Found in GRU2

MIDEWIN TALLGRASS PRAIRIE AREAS (USDA)			INDUSTRIAL PARK AREAS				
Sites		**M1**	**M5**	**M6**	**M7**	**M8**	**M13**
Maximum Concentration Exceeding Class II RGs (µg/l)							
	RG (µg/l) USDA						
Explosives							
1,3,5-TNB	5.1			240			15.5
2,4,6-TNT	9.5		16.7	2,600	9.5		12.9
2,4-DNT	0.42			3,200	200	9	126
2,6-DNT	0.42	.608	5.53	2,700	70	0.53	39
2-NT	1,000			21,000			
NB	51			81.8			
RDX	2.6			52.7	46		
Metals							
Antimony	24	31				31	38.7
Cadmium	50			162			56
Iron	5,000		42,000			48,000	
Organics							
Tetrachloroethene	25			150			
Affected Aquifers		GD, SB	GD	GD,SB	GD,SB	GD	GD
Contaminated Volume (MG), Total	<u>**542**</u>	62	96	96	96	96	96

Key: GD glacial drift, shallow aquifer
SB shallow bedrock aquifer

5.2.2.5 Site M8 (Acid Manufacturing Area)

Site M8 was described in Section 5.1.6.1.

2,4-DNT was detected in two samples taken from the MW147 in concentrations 9 µg/L and 5 µg/L. 2,4-DNT was also detected in a sample taken from the MW325 at a concentration of 0.531 µg/L. Groundwater impacted by explosives in the site M8 is mostly due to leaching of isolated “hot spots” that have been largely depleted in the years since the facility was active. In addition to explosive contamination, iron was detected (48,000 µg/L) above the established background levels in a sample collected from the MW107.

No RCRA hazardous wastes were identified in the groundwater at Site M8.

5.2.2.6 Site M13 (Gravel Pits)

Site M13 was described in Section 5.1.6.6.

Fifty-six samples of groundwater have been collected and analyzed for explosives. Of these, seven samples contained detectable concentrations of four explosives (2,4,6-TNT, 2,6-DNT, 1,3,5-TNT, 2,4-DNT).

Concentrations of explosives in soil samples found along the TNT Ditch may be a source for the explosives in the groundwater. In addition to the explosive contamination, antimony was detected in MW322 at the concentration of 38.7 µg/L. Also, cadmium was detected in the MW126 at the concentration of 56 µg/L.

No RCRA hazardous wastes were identified in the groundwater at Site M13.

5.2.3 GRU3. Volatile Organic Compounds- MFG Area

GRU3, VOCs in Groundwater, is entirely in the MFG Area and consists of separate toluene plumes emanating from sources in the western and central sections of Site M10, the Toluene Tank Farms, and of a benzene plume found at M3 (Figure 4). The toluene plumes at Site M10 are in the overburden (glacial drift) aquifer of both the western and central tank farm sections of Site M10, and in the upper bedrock aquifer of the western tank farm section of M10 (Table 5-20). The benzene' plume at Site M3 is in the upper bedrock aquifer. Table 5-21 lists exceedances of Remedial Goals (RGs) for sites included in GRU3.

Table 5-19 Sites Overlying GRU3 VOCs in Groundwater – MFG Area

Sites	Subareas	Volume (MG)
M3	Flashing Grounds	0 (1)
M10	Western and Central Toluene Tank Farms	3
Total		**3**

Note: (1) Volume estimate not made for Site M3. Benzene expected to be degraded below RG since 1991.

5.2.3.1 Site M3

Site M3 is described in Section 5.1.1.9.

In 1991, twelve samples (including one duplicate) were taken from eleven monitoring wells at Site M3 and analyzed for VOCs (as well as explosives, anions, metals, and semi-volatile compounds). One well, MW233, was found to contain benzene in excess of the Class I water quality standards. No other detections of benzene occurred. No other VOCs were found in any M3 wells in concentrations exceeding Class I standards. No other samples at M3 have been analyzed for VOCs before or since 1991. Sampling and analysis will be performed to confirm whether or not benzene has degraded in the plume under Site M3 since 1991.

No RCRA hazardous wastes were identified in the groundwater at Site M3.

5.2.3.2 Site M10

Site M10 in the northern portion of the MFG Area contains three toluene tank farms. Each of the tank farms covers approximately 5 acres and was in use through 1976. Four ASTs, each with a capacity exceeding 1 million gallons of toluene, were constructed in each tank farm. For the period during World War II in which nitroxylenes were manufactured at the JOAAP, xylenes were stored in two of the three tank farms. The specific tanks used for xylene storage are not known. In separate incidents in August

1968 and July 1971, lightning destroyed the northwestern and southwestern ASTs in the Western Toluene Tank Farm. An estimated 1.1 x 10^6 gallons of toluene were lost in each of the explosions and subsequent fires. Spill records also indicate that an AST in the Central Toluene Tank Farm was struck by lightning in June 1971. The tank was not destroyed; however, an unknown volume of toluene was lost.

Toluene was detected in two samples at the Central Toluene Farm in MW224 at the concentration 20,000 µg/L and 6,000 µg/L, respectively. In the Western Toluene Tank Farm, toluene was detected in two samples in MW220 at the concentrationof 10,000 µg/L and 19,600 µg/L, respectively. The presence of toluene in groundwater but absence in soil has been explained as the result of a high water table and thin overburden creating a flushing mechanism for the overburden. The suspected source is from a spill from two tanks ruptured after being struck by lightning.

No RCRA hazardous wastes were identified in the groundwater at Site M10, except for the toluene, which was used as a raw material or commercial chemical product (RCRA waste code U220).

Table 5-20 Exceedances of Remediation Goals (Rgs)
as a Function of Land Use for Groundwater Found in GRU3

MIDEWIN TALLGRASS PRAIRIE AREAS (USDA)				INDUSTRIAL PARK AREAS	
Sites		**M3**	**M10 Central**	**Sites**	**M10 West**
Maximum Concentration Exceeding Class I, Class II and Risk Based, Park Exployee RGs (µg/l)					
	RG (µg/l) USDA			**RG (µg/l) IND. P**	
Volatile Organic Compounds (VOCs)					
Benzene	5	15.8		25	
Toluene	2,500		19,600	2,500	20,000
Affected Aquifers		SB	GD		GD,SB
Contaminated Volume (MG), Total	**3**	0	1.5		1.5

Key: GD glacial drift, shallow aquifer
SB shallow bedrock aquifer

5.14 GOU No Further Action Sites

Fifty-three (53) sites plus three (3) subareas suspected as having groundwater contamination were investigated during the RI/FS and Risk Assessment process. The groundwater underlying 41 of these sites and the three subareas was found to have no historical evidence suggesting contamination potential, no contamination, or contaminant concentrations that do not pose a threat to human health or the environment. IEPA and USEPA agree that, under CERCLA requirements, no further cleanup actions are required for these sites. The groundwater underlying these NFA sites and subareas, and the reason for their designation for no further action, are presented in further detail in Section 6.6.

[END OF SECTION]

6 SUMMARY OF SITE RISKS

A human health and environmental risk assessment was performed for soils, surface water, sediments, and groundwater at JOAAP. The objective of this assessment was to evaluate current and future exposures associated with contaminated soils, sediment, surface water and groundwater at the sites in the absence of remediation actions. The risk assessment analyzed the toxicity and degree of hazard posed by site soil, sediment, surface water and groundwater contaminants. This assessment also described the probable routes by which they come into human or ecological contact.

Risk assessment consists of evaluating the types and levels of contaminants present, the pathways by which receptors could potentially be exposed to these contaminants, and the toxicity and/or carcinogenicity of the contaminants. The Army conducted historical reviews, site inspections, and remedial investigations to analyze the nature and extent of soil and groundwater contamination in both the LAP and MFG Areas of the JOAAP. The Army also conducted environmental studies on the impacts of contamination on plant and animal populations. Four reports, the "Baseline Risk Assessment" (Dames & Moore, 1994), "Phase 1 Ecological Risk Assessment Report" (USACHPPM, 1994), "Phase 2 Aquatic Ecological Risk Assessment Report" (USACHPPM, 1996), and "Preliminary Remediation Goals" (OHM, 1996) were developed. These reports include a quantitative estimate of the potential for adverse health and ecological effects that may occur if no remedial actions were implemented at the contaminated sites.

Data are available to form a conceptual model of the contaminated areas. The model considers the sources of contamination, the manner in which the contaminants were released to the soil and groundwater, and the distribution of the contaminants both in depth and in area extent. This conceptual model was used to develop soil and groundwater remediation goals. The final RGs is are the maximum concentrations of contaminants that could remain on-site while resulting in risks within the USEPA's acceptable range. Soil and groundwater that is contaminated in excess of these final RGs, therefore, may pose a threat to human health that is higher than these acceptable risk levels.

Standard risk assessment assumptions and equations were used to perform the calculations needed to derive soil and groundwater RGs.

6.1 Human Health Risk

6.1.1 Human Health Risk Assessment

Human health risk estimates were made for site-related contaminants that can cause cancer (carcinogens) and for non-cancer causing compounds (non-carcinogens). The National Contingency Plan (NCP) establishes acceptable levels of carcinogenic risk for Superfund sites as ranging from 1 in 10,000 (1×10^{-4}) to 1 in one million (1×10^{-6}) excess cancer cases. "Excess" means the number of cancer cases in addition to those that would ordinarily occur in a population due to non-site-related factors. For non-cancer causing compounds, a risk estimation known as the "hazard index" is used. Typically, hazard indices below one (1.0) indicate that no adverse health effects are expected, and values above 1.0 are indicative of possible adverse effects.

The human health risk assessments identified a total of 79 contaminants of concern in JOAAP soil and sediment, 40 contaminants of concern in groundwater, and 45 contaminants of concern in surface water.

Explosives (primarily TNT, DNT, RDX, HMX, and tetryl) were the most prevalent contaminants of concern in each of these media, although other contaminants (metals, pesticides, PCBs, and volatile and semivolatile organic compounds) were also identified.

The planned use of JOAAP as outlined in Public Law 104-106, provided the basis for estimating the extent and duration of exposure to the contaminants at JOAAP. People who were determined to be potentially exposed to the contaminants at JOAAP include recreational park users and industrial workers. The risk assessment also included assessment of a hypothetical residential exposure scenario for comparison purposes. These persons were assumed to be exposed to contaminated soils, surface water, and sediments either by dermal contact or by incidental ingestion. Exposure to groundwater was assumed to be via dermal contact, ingestion of drinking water, and inhalation of vapors while showering. Appendix A, provides the summaries of reasonable maximum exposure (RME) risk characterizations done within the Baseline Risk Assessment studies at JOAAP.

Risks and hazards posed to receptors were calculated for each site at the MFG and LAP Areas. Table 6-1 identifies those sites and media where the calculated risk levels exceed 1×10^{-6} or the hazard index exceeds 1.0 for a recreational user and an industrial worker. Surface water was found to pose risks exceeding 10^{-6} in the TNT Ditch located at Sites M6 and M7 because of the periodic run-off of explosives contaminated soils into the surface water. Remediation of the soils and sediments in this ditch will serve to prevent the run-off of explosives into the surface water and effectively reduce any risk. The sediments that posed unacceptable risks and hazards are found in drainage ditches that are often dry rather than sediments in streams, creeks, and lakes present at JOAAP, and are considered to be similar to soils in terms of exposure pathways.

The risk assessment also modeled potential risks to consumers of fish caught in JOAAP streams, and identified potential risks caused by the estimated presence of arsenic, beryllium, and explosives in the fish tissue. Subsequently, as part of the Ecological Risk Assessment, fish samples were collected and these analytes were not detected in the fish tissue. This indicates that the model did not represent actual site conditions, and that the consumption of the fish does not pose a risk.

At sites where calculated risks or hazards exceeded the acceptable levels for future recreational park users and industrial workers, remedial alternatives were developed. These remedial alternatives will be implemented as final for all GRUs, for all industrial park SRUs and for certain SRUs on USDA lands in order to reduce the risk to acceptable levels. These remedial alternatives are considered interim for the remaining SRUs on USDA lands. Notable exceptions to this aresites M 11, M 13, and L4, where risks and hazards do not exceed the acceptable levels., but because these sites contain landfills, remediation is required to comply with State regulations.

Based on information presented in the human health risk assessments, the principal threat to human health results from potential exposure to explosives in soil. DNT is identified by USEPA as a probable human carcinogen, and both TNT and RDX are identified by USEPA as possible human carcinogens. Risks and hazards calculated for groundwater are based on the assumption that new wells are installed into areas of contaminated groundwater and then used. This scenario is unlikely to occur because the majority of the contaminated groundwater resides in the glacial drift aquifer that does not provide usable quantities of groundwater and is not used as a water supply at JOAAP.

TABLE 6-1
Summary from Baseline Risk Assessment of Sites Where Risks Exceed 10^{-6} and Hazard Indices Exceed 1.0 for Recreational Users and Industrial Workers

		Soil		Groundwater		Surface Water		Sediment	
Site ID	Receptor	Risk	Hazard	Risk	Hazard	Risk	Hazard	Risk	Hazard
M1	Recreational User	V			V				
M2	Recreational User		V						
M3	Recreational User	V	V						
M4	Recreational User	V	V						
M5	Industrial	V	V	V	V			V	
M6	Industrial	V	V	V	V	V		V	V
M7	Industrial	V	V	V		V		V	
M8	Industrial								
M9	Industrial								
M10(a)	Industrial/Recreational			V	V				
M11	Recreational User								
M12	Recreational User							V	V
M13	Industrial								
M14	Recreational User								
M15	Industrial								
M16	Industrial								
M17	Industrial								
M18	Industrial								
L1	Recreational User	V	V	V	V				
L2(b)	Recreational User	V	V	V	V				
L3	Recreational User	V		V					
L4	Recreational User								
L5	Recreational User	V	V						
L6(c)	Industrial								
L7	Recreational User	V							
L8	Recreational User	V							
L9	Recreational User	V	V						
L10	Recreational User	V	V						
L11	Industrial	V							
L12	Recreational User								
L13	Recreational User								
L14	Recreational User	V	V	V	V				
L15	Recreational User								
L16	Industrial	V	V						
L17	Industrial	V							
L18-L23	Recreational User								
L23A	Recreational User	V	V						
L24-L31	Recreational User								
L32	Industrial								
L33-L35	Recreational User								

(a) The central toluene tank farm is located in the industrial park
(b) Oil Pits at L2 were remediated during a removal action in 1996.
(c) Site L6 was remediated during a removal action in 1997.

6.1.2 Assessment of Risk to Prairie Workers

The risk of exposure to contaminants in soil for workers conducting prairie establishment and maintenance activities on the property currently managed by, or intended for the USDA will be evaluated consistent with USEPA current risk assessment guidance for Superfund. The Army, USEPA and IEPA will conduct this evaluation of risks to prairie workers in consultation with the Secretary of Agriculture and the Illinois Department of Natural Resources. This evaluation will exclude USDA properties contained within SRUs 4, 6 and 7. After such evaluation, final soil RGs will be established. Subsequently, volumes and areas requiring remedial action will be determined. Final remedial actions for USDA soils will be selected in accordance with the NCP.

6.2 Ecological Risk Assessment

6.2.1 Ecological Risk Assessments Conducted

In addition to the human health riskassessment, the Army conducted an ecological risk assessment (ERA). The ERA documents are "Final Ecological Risk Assessment, Phase 1" (11/l/94), and "Final Phase 2 Aquatic Ecological Risk Assessment" (1/2/97). The ERA process is designed to provide the justification for performing remedial actions based upon risk to the environment, if unacceptable risks exist or will exist in the foreseeable future. The ERA findings are described below.

Hazardous chemical substances were not found to significantly impact the aquatic components of the JOAAP ecological system. Water quality, habitat, and the health of fish, crayfish, invertebrates, and other aquatic organisms were examined in Grant, Jackson, Jordan, Prairie, and Spoil Bank Creeks. Fish at JOAAP appear healthy and histopathological evidence found no contaminant-related toxic effects. Tissue samples from fish and crayfish were analyzed for explosives (none detected), metals (zinc, iron and barium detected, but below action levels), PCBs (none detected), and pesticides (trace 4,4'-DDE detected at normal background levels). Surveys of the sediment macroinvertebrates found no biologically significant differences related to hazardous chemicals between the streams on JOAAP and those off the installation. Water quality was degraded at one study area; however, the condition was not linked to hazardous chemicals of concern.

Hazardous substances were not found to significantly impact the terrestrial components of the JOAAP ecological system. Habitat, historical biological surveys, soil toxicity, and the health of small mammals and deer were examined. Tissue samples from rodents and deer within the study areas were analyzed for heavy metals and explosives. These tissues were found to not contain metals at concentrations above those found in samples collected from the reference sites (i.e., background). Additionally, explosives were found to not accumulate in these tissues. [Note: The deer tissue study was focussed on the consumptability of the meat, not on the ecosystem impacts of the contaminants, if any, in the deer.] A rodent biomarker study was conducted to compare rodents on JOAAP and off-site on the basis of bone marrow micronucleus assays, histopathology, and hematology. The variations between on-site and offsite rodents were found to be either statistically insignificant or unrelated to possible chemical exposure.

Safe soil concentrations for hazardous chemicals representing preliminary remediation goals (PRGs) were developed for the protection of the Upland Sandpiper, a State-listed endangered species. Several conservative assumptions were used to calculate the future and current use PRGs for this grassland bird. For example, future use PRGs were based on increasing prairie remnant acreage at a portion of the facility without first addressing the soil contamination at these areas. Under the future use scenario, for the 5 out of 12 months that the species resides at JOAAP, 100% of the sandpipers' time was assumed to be spent on-site. Uncertainties associated with the ecological PRGs include thc lack of toxicity information on the effects of explosives on avian species and the use of data from other avian species for the Upland Sandpiper. Only one avian study on the toxicity of polynuclear aromatic hydrocarbons (PAHs), chrysene, was found. This toxicity value was applied to other PAHs of concern because of the similar physiological mode of action of this chemical class. This technique introduces large uncertainty to the PRGs provided for PAHs other than chrysene. Population surveys of the Upland Sandpiper conducted by the Illinois Department of Conservation over several years beginning in 1983 indicate the populations of these birds are relatively stable on JOAAP and represent some of the best biological resources in northern Illinois. This is primarily due to the extensive acreage of grazed land and prairie remnants at JOAAP that provide habitat for grassland bird species. The areas contaminated with chemicals of concern at JOAAP represent a small percentage of the 23,542-acre installation and are areas that were previously developed for industrial activities (contain buildings, roadways, parking lots, railroad tracks, etc.) and currently do not provide desirable habitat for the Upland Sandpiper.

Soil toxicity tests conducted on field-collected soils at several JOAAP study sites found evidence of excess toxicity for earthworm survival and growth, plant seed germination and growth, and soil microrganisms. Some tests recorded toxicity due to metals and RDX, however, the greatest adverse effects for all tests were found in soils with TNT contamination. The spatial scale where these toxic effects are found is very small (less than 1%) relative to the entire JOAAP ecological system.

A survey of the endangered and threatened plant and animal species was conducted at the Joliet Army Ammunition Plant and Joliet Training Area and completed in 1994 (Glass, 1994).

6.2.2 Protection of Ecological Resources

The largest portion of contaminated soils is concentrated in land that is designated for industrial parks under PL 104-106 and is not intended for ecosystem development.

Exposure levels for ecological resources that are protective of the environment and compatible with development of the tallgrass prairie will be determined for the USDA lands. Exposure levels will initially be established by a site-specific biological technical assistance group (BTAG) that shall include, at a minimum, representatives of the Army, USEPA, IEPA, USDA, Illinois Department of Natural Resources, and Department of Interior/US Fish and Wildlife Service. The exposure levels established by the BTAG shall be compared to the human health risk-based remediation goals established for the USDA lands. Appropriate final remedial actions for USDA soils will be developed, evaluated and selected in accordance with the NCP.

6.3 Remedial Action Objectives (RAOs)

The primary objective of the cleanup at JOAAP is to effectively mitigate, minimize threats to, and provide adequate protection of human health and the environment. To meet this objective, the Army developed remedial action objectives for the soil and groundwater OUs. The objectives of the final remedial actions are summarized as:

1. Clean up contaminants to the site-specific and chemical-specific remediation goals (RGs);
2. Prevent human and environmental exposure to contamination at concentrations above the RGs;
3. Eliminate soil contamination as a continuing source of groundwater contamination;
4. Prevent migration of contaminants; and
5. Actions will not leave behind any characteristically hazardous RCRA wastes, except those contained within the capped landfills of SRU6.

The objectives of the interim remedial actions are summarized as:

1. Eliminate soil contamination as a continuing source of groundwater contamination; and
2. Prevent migration of contaminants.

6.4 Development of Remediation Goals (RGs)

Human health risk models and other appropriate USEPA and IEPA criteria were used to establish the RGs for each of the 79 contaminants of concern identified in the soils, and for each of the 40 contaminants of concern identified in the groundwater. In conjunction with the human health and ecological risk assessments, the RG values serve as threshold criteria for identifying sites that require remedial action. The final RGs were established to develop concentrations of contaminants that provide a "safe" level. For carcinogens, a "safe" level is defined as a concentration in soil or water that does not pose a risk that exceeds the 1 x 10^{6} level. For non-carcinogens, a "safe" level is defined as a concentration that does not pose a hazard that exceeds the 1.0 level.

Final RGs for soil were established for industrial land use (industrial parks, VA cemetery, WCLF) scenarios. Ecological PRGs were not used in the development of final RGs for the Industrial areas since they were considered inappropriate given the future land use. Table 6-2 lists the final RGs for soil.

Interim soil RGs are presented for USDA lands in Table 6-2. Final soil RGs that are protective of human health and the environment will be incorporated into the Final ROD for USDA lands for SRUs 1, 2, 3 and 5.

Table 6-2 also presents the final RGs for groundwater. IEPA Class I and Class II groundwater standards were used as the RGs for potable and industrial uses, respectively. When IEPA standards were not available for a particular compound, risk-based concentrations (RBCs) were developed and used as the RGs. The RBC calculations assumed that groundwater would be used by an industrial worker and used the 1 x 10^{-6} level for carcinogens and 1.0 level for non-carcinogens.

The RGs for groundwater are dependent on the aquifer in which the contamination is present. If contamination is present in the glacial till, the Illinois Class II groundwater quality standards will be used, and if contamination is present in the Silurian Dolomite, the Illinois Class I groundwater quality standards will be used. Groundwater management zones (GMZs), as described in Section 9.2.1.1, will be established around areas where groundwater is contaminated.

6.5 Exceedances of RGs

The Army compared the concentrations of 79 contaminants of concern with their respective RGs (Table 6-2) and determined that 19 contaminants exceed RGs in soil. On the basis of this review, the Army narrowed its focus to the cleanup of specific sites. RGs were used both for surface and subsurface soils. However, the Army reserves the right to work with USEPA and IEPA to perform risk management review and address unknown conditions encountered during remedial actions. The same analysis determined that 13 contaminants exceeded their respective RGs in the groundwater.

Table 6-2: Soil, Sediment, and Groundwater Remedial Goals (µg/g, µg/L)					
Contaminant	**Soil – USED** *(1)***	**Soil – Industrial *(1)***	**Class I *(2)* Groundwater**	**Class II *(3)* Groundwater**	**RB *(4)* Groundwater**
Explosives					
1,3,5-TNB	180	100	NA	NA	5.1
1,3-DNB	370	200	NA	NA	10
2,4,6-TNP	7,400	4,100	NA	NA	200
2,4,6-TNT	290	190	NA	NA	9.5
2,4-DNT	13	8.4	NA	NA	0.42
2,6-DNT	13	8.4	NA	NA	0.42
2-NT	10,000	10,000	NA	NA	5,100
DNAP	7,400	4,100	NA	NA	200
HMX	10,000	10,000	NA	NA	5,100
NB	1,800	1,000	NA	NA	51
RDX	78	52	NA	NA	2.6
Tetryl *(5)*	7,400	4,100	NA	NA	200
Metals					
Aluminum	1,000,000	1,000,000	NA	NA	100,000
Antimony	1,500	820	6	24	NA
Arsenic	5.7	3.8	50	200	NA
Barium	260,000	140,000	NC	NC	NC
Beryllium	2	2	NC	NC	NC
Cadmium	3,000	1,700	5	50	NA
Chromium (+3)	110,000	13,000	100	1,000	NA
Chromium (+6)	11,000	1,600	100	1,000	NC
Cobalt	220,000	120,000	NC	NC	NC
Copper	150,000	82,000	NC	NC	NC
Iron	1,000,000	610,000	5,000	5,000	NA
Lead *(6)*	1,000	1,000	7.5	100	NA
Manganese	450,000	150,000	150	10,000	NA
Mercury	1,100	610	NC	NC	NC
Nickel	74,000	41,000	NC	NC	NC
Selenium	18,000	10,000	NC	NC	NC
Silver	18,000	10,000	50	511	NA
Thallium	290	160	NC	NC	NC
Vanadium	26,000	14,000	NC	NC	NC
Zinc	1,000,000	610,000	5,000	10,000	NA
Volatiles					
1,1,1-Trichloroethane	NC	NC	200	1,000	NA
1,1,2-Trichloroethane	NC	NC	5	50	NA
1,1-Dichloroethane	NC	NC	700	3,500	NA
1,2-Dichloroethane	NC	NC	5	25	NA
1,2-Dichloroethene	NC	NC	70	200	NA

Table 6-2: Soil, Sediment, and Groundwater Remedial Goals (µg/g, µg/L)					
Contaminant	**Soil – USED** *(1)***	**Soil – Industrial *(1)***	**Class I *(2)* Groundwater**	**Class II *(3)* Groundwater**	**RB *(4)* Groundwater**
Acetone	1,000	1,000	NC	NC	NC
Benzene	300	200	5	25	NA
Chlorobenzene	NC	NC	100	500	NA
Ethylbenzene	1,000	1,000	700	1,000	NA
Tetrachloroethane	NC	NC	5	25	NA
Toluene	1,000	1,000	1,000	2,500	NA
Trichloroethane	NC	NC	5	25	NA
Xylenes	1,000	1,000	10,000	10,000	NA
Semivolatiles					
1,2-Dichchlorobenzene	10,000	10,000	NC	NC	NC
1,3-Dichchlorobenzene	10,000	10,000	NC	NC	NC
1,4-Dichchlorobenzene	360	240	NC	NC	NC
2-Methylnaphthalene	10,000	10,000	NC	NC	NC
2-Methylphenol	NC	NC	NA	NA	5,100
4-Methylphenol	NC	NC	NA	NA	510
1,2,4-Trichlorobenzene	10,000	10,000	NC	NC	NC
Acenaphthene	10,000	10,000	NC	NC	NC
Acenaphthylene	10,000	10,000	NC	NC	NC
Anthracene	10,000	10,000	NC	NC	NC
Benzo(a)anthracene	12	8	NC	NC	NC
Benzo(a)pyrene	1	1	NC	NC	NC
Benzo(g,h,i)perylene	10,000	10,000	NC	NC	NC
Benzo(b)fluoranthene	12	8	NC	NC	NC
Benzo(k)fluoranthene	120	78	NC	NC	NC
Benzyl alcohol	NC	NC	NA	NA	31,000
Bis(2-ethylhexyl)phthalate	610	410	NC	NC	NC
Butyl benzyl phthalate	NC	NC	NA	NA	20,000
Chrysene	1,200	780	NC	NC	NC
Dibenz(a,h)anthracene	1.2	0.78	NC	NC	NC
Dibenzofuran	10,000	10,000	NC	NC	NC
Diethyl phthalate	10,000	10,000	NC	NC	NC
Di-n-butyl phthalate	10,000	10,000	NC	NC	NC
Di-n-octyl phthalate	10,000	10,000	NC	NC	NC
Fluoranthene	10,000	10,000	NC	NC	NC
Fluorene	10,000	10,000	NC	NC	NC
Hexachlorobenzene	5.4	3.6	NC	NC	NC
Inden[1,2,3-cd]pyrene	12	7.8	NC	NC	NC
Naphthalene	10,000	10,000.0	NC	NC	NC
Phenanthrene	10,000	10,000	NC	NC	NC
Phenol	10,000	10,000	NC	NC	NC
Pyrene	10,000	10,000	NC	NC	NC

Table 6-2: Soil, Sediment, and Groundwater Remedial Goals (µg/g, µg/L)					
Contaminant	**Soil – USED** *(1)***	**Soil – Industrial *(1)***	**Class I *(2)* Groundwater**	**Class II *(3)* Groundwater**	**RB *(4)* Groundwater**
Anions					
Nitrate/Nitrite	1,000,000	1,000,000	10,000	100,000	NA
Phosphate	370,00	200,000	NC	NC	NC
Phosphorous	370,000	200,000	NC	NC	NC
Sulfate	456	456	400,000	400,000	NA
Pesticides, PCBs					
Chlordane	6.6	4.4	NC	NC	NC
DDD	36	24	NC	NC	NC
DDE	25	17	NC	NC	NC
DDT	25	17	NC	NC	NC
Dieldrin	0.54	0.36	NC	NC	NC
Endrin	1,100	610	NC	NC	NC
Heptachlor	1.9	1.3	NC	NC	NC
Heptachlor epoxide	0.94	0.63	NC	NC	NC
Isodrin	1,000	1,000	NC	NC	NC
PCB 1254	1	1	NC	NC	NC
PCB 1260	1	1	NC	NC	NC
Organics-Special					
TPH	2,500		NC	NC	NC

Notes

** *The gray-shaded cells indicate interim RGs*

(1) *The soil Rgs for all contaminants except PCBs apply to both surface and subsurface soils.*

(2) *Illinois Groundwater Quality Standards for Class I Groundwater (35 1A C 620.4 10)*

(3) *Illinois Groundwater Quality Standards for Class II Groundwater (35 IAC 620.420)*

(4) *Risk-Based Concentration (RBC for Groundwater based on USEPA conmmercial/industrial exposure scenario as presented in PRG Report (OHM, 1996).*

(5) *The USEPA, IEPA and the Army agreed to base the RG for tetryl on one of its primary breakdown products, dinitroaminophenol (DNAP), because of concern over the reliability of the risk-based value applied to tetryl at the time.*

(6) *The USEPA, IEPA and the Army agreed to revise the RG for lead to 1,000 µg1g, over USEPA's screening level of 400 pg1g. This adjustment was made because exposure of children to the lead-contaminated soils is substantially less frequent than could occur in a residential setting and the decreased sensitivity of adults (including workers at the site) to the effects of lead*

(7) *The cleanup goal for PCBs is 1 µg/g for surface soils (upper ten inches of soil) and 10,µg/g for subsurface soils. These goals match those established under TSCA for non-restricted access areas, and were agreed to by the USEPA, IEPA and the Army.*

NC *chemical is not a contaminant of concern in given media*

NA *Not available (for Class I and Class H Groundwater columns), or*
Not applicable (for RBC Groundwater column)

6.6 No Further Action Sites

Twenty-eight (28) sites and two subareas suspected as having contaminated soil were investigated during the RI/FS and Risk Assessment process and found to have no evidence of' contamination, no contamination, or contamination at concentrations that do not pose a threat to human health or the environment. IEPA and USEPA agree, under CERCLA requirements, no further cleanup actions are required for these sites, Table 6-3 presents the No Further Action (NFA) sites for soil.

Groundwater underlying 41 sites and three subareas was found to have no evidence of contamination, no contamination, or contamination at concentrations that do not pose a threat to human health or the environment. IEPA and USEPA agree, under CERCLA requirements, no further cleanup actions are required for the groundwater underlying these sites based on current information. Table 6-4 presents the NFA sites for groundwater.

Table 6-3 CERCLA No Further Action Sites – Soil

Site No.	Site Description	Which Phase Determined No Action?	Reason for NFA	Source of Information
L6	Group 70	Removal Action	Various COCs (TPH,PCBs,BNAs) were detected at site in excess of Rgs. Removal action conducted at site to remove health and environmental hazards.	Removal Action Report, 3/98
L12	Doyle Lake	FS	COCs (explosives, pesticides, PCBs and metals)detected in sediments, but exposure pathway considered incomplete. Surface water does not pose a risk for residents (based on Jordon Creek analysis).	FS, 9/26/97, p.10-37 and 10-6
L13	Group 68	BRA	COCs (explosives) detected. Risk determined to be within acceptable range for all scenarios including residential use.	BRA, 2/3/95, p.7-63
L15	Group 5	BRA	COCs (TPHs, explosives) detected. Risk determined to be within acceptable range for all scenarios including residential use	BRA, 2/3/95, p.7-71
L18	Group 8	FS	Depleted uranium cleanup conducted under U.S. Nuclear Regulatory Commission license at site. Closeout report prepared for radionuclides.	BRA, 2/3/95, p.7-82; Alliant Techsystems, 1997
L19	Group 9	FS	Lead detected below background levels. No other site-related contaminants identified.	FS,9/26/97, p.10-42
L20	Group 20	RI-PH1	No site-related contamination identified at Group 20.	RI-PH1, 7/1/93,p.6-21
L21	Group 23	RI-PH1	No evidence to suspect soil contamination at this sites. No soil sampling was conducted.	RI-PH1, 7/1/93,p.6-22
L22	Group 25	RI-PH1	No evidence to suspect soil contamination at this sites. No soil sampling was conducted.	RI-PH1, 7/1/93,p.6-22
L23	Group 27	RI-PH1	COCs (metals, explosives) only detected in pit, which was designed as 23A and continued in	RI-PH1, 7/1/93,p.6-22

Site No.	Site Description	Which Phase Determined No Action?	Reason for NFA	Source of Information
			remedial action. No potential site-related contaminations identified in other areas of L23.	
L24	Group 29	RI-PH1	No historical evidence of spills or areas of concern identified at site 24.	RI-PH1, 7/1/93,p 5-672, and 6-23
L25	Group 62	RI-PH2	No potential site-related contaminants identified.	RI-PH2, 12/94, p 6-14
L26	Group 63	RI-PH1	No potential site-related contaminants identified.	RI-PH2, 12/94, p 6-23
L27	Group 64	RI-PH1	No historical evidence of potential site-related contaminants identified.	RI-PH1, 7/1/93, p.p-711 and p.6.24
L28	Group 65	RI-PH1	No historical evidence of potential site-related contaminants identified. No soil samples taken.	RI-PH1, 7/1/93, p.6-710 FS, 9/26/97, p 1-2
L29	Group 66	RI-PH1	No historical evidence of releases or areas of concern identified.	RI-PH1, 7/1/93,p.5-711, p.6-24
L30	Group 66A	RI-PH1	No historical evidence of releases or areas of concern identified.	RI-PH1, 7/1/93,p5-711, p 6-24
L31	Extraction Pits	RI-PH1	Soil samples analyzed for VOCs, BNAs, pesticides/PCBs, metals and anoins. No site-related contaminants identified.	RI-PH1, 7/1/93,p.5-717, p 6-25
L32	Group 60	FS	COCs (TPH, lead, zinc) are below RGs. HI estimated to be below .01 for all scenarios including residential.	BRA, 2-3/95, p.9-7 FS, 9/26/97, p 10-42
L33	PVC Area	BRA	Explosives (2,4,6-TNT,RDX) detected, below RGs. Cadmium above background level (but well below RGs) in several samples. Both carcinogenic risk and HI estimated well within acceptable range for all scenarios, including residential.	RI-PH1,7/1/93,p.5-735, p.6-25; BRA, 2/3/95, p.7-92
L34	Former Burning Area	BRA	COCs (metals, VOCs, BNAs) detected, but well below RGs. HI estimated to be below .01 for all scenarios including residential.	RI-PH1,7/1/93,p.5-742, p.6-26; BRA, 2/3/95, p.7-95, 9-7
L35	Fill Area	RI-PH1	Elevated metals concentrations found in Kemery Lake sediment apparently not based on activities at Site 35.	RI-PH1,7/1/93,p.5-781, p.6-27
M6A	TNT Blocking Area	FS	No samples taken within 6A. Three sets of area soil clusters taken near perimeter of 6A showed no detections of explosives, VOCs.	RI-PH2, 5/93, p.5-255, FS, p. 9/29/97, p.2-18
M10	Toluene Tank Farm	RI-PH2	VOCs (acetone, chloroform, toluene) detected at concentrations that wee too low (max of 0.032 µg/g) to pose a threat to human health or the environment.	RI-PH2, 5/93, p.5-506, p.6-13
M14	Former Pond	BRA	COCs (BNAs, metals) detected. HI less than 0.01 for all scenarios, including residential.	BRA, 12/5/94, p. 3-55, p.9-26
M15	Sewage Treatment Plant	BRA	COCs (BNAs, metals, anions) were detected below RGs – except for arsenic which was found in one of four samples at 5.1 µg/g [above RGs for industrial, but below probable	RI-PH2, 5/93, p.5-641, BRA, 12/5/94, p. 3-57

Site No.	Site Description	Which Phase Determined No Action?	Reason for NFA	Source of Information
			back ground levels]. His less than 1.0 for all scenarios, including residential. Maximum carcinogenic risks for the site were estimated to be 1.3E-5 for the residential and 2.1E-6 for the industrial workers. These risks are less than the less stringent acceptable limit (1E-4) [see note 1, below]. M15 was thus considered to require no further action.	
M16	Motor Pool Area	RI-PH2	COCs (BNA, pesticides, metals) were detected at M16. Site related contaminants and potential risks at site considered low enough to require no further action.	RI-PH2, 5/93, p.5-664, p 6-20
M17	Laundry Facility	RI-PH2	No site-related contaminants were detected at M17.	RI-PH2, 5/93, p 5-673, p 6-21
M18	Herbicide Storage	RI-PH2	No site-related contaminants were detected at M18	RI-PH2, 5/93, p. 5-673, p 6-21

Note: (1) After the BRA, the carcinogenic risks at M15 were recalculated because an improperly high concentration of beryllium was used. Risks were found to be below 1.0E-6 for all scenarios under this recalculation.

Key:

BNA	Base-Neutral-Acids (Semivolatiles)
BRA	Baseline Risk Assessment
COC	Contaminant of Concern
FS	Feasibility Study
HI	Hazard Index
RG	Remedial Goal
RI-PH1	Remedial Investigation, Phase 1
RI-PH2	Remedial Investigation, Phase 2
TPH	Total Petroleum Hydrocarbon
VOC	Volatile Organic Compound

Table 6-4 CERCLA NO Further Action Sites – Groundwater

Site No.	Site Description	Which Phase Determined No Action?	Reason for NFA	Source of Information
L4	Landfill Area	PRG	CCS (VOCs, anions, metals) detected in two wells at L4 are below the RGs. Carcinogenic risk for residential use in estimated at 2E-5; HI is IE-4. Groundwater is not considered to pose a threat to human health or the environment. At L4.	RI-PH1, 7/1/93, p. 5-273; BRA, 2/3/95, p.9-4; PRG document, 4/1/96
L5	Salvage Yard	PRG	CCS (VOCs, BNAs, anions, metals) are below the RGs. The His is estimated to be 3.0 for a residential use scenario. Hazard are due to manganese found in the wells screened in the glacial till, a Class II aquifer, which is not capable of yielding usable quantities of water.	RI-PH1, 7/1/93, p. 5-219; BRA, 2/3/95, p.9-4; PRG 4/1/96
L6	Group 70	PRG	CCS (VOCs, BNAs, anions, metals) detected are below the RGs. Carcinogenic risk (3E-4) and HI (1.0) were based on a residential use scenario. Risk and hazards were due to arsenic found in a well screened in the glacial till, a Class II aquifer, which is not capable of yielding usable quantities of water.	RI-PH1, 7/1/93, p. 5-335; BRA, 2/3/95, p.9-5; PRG 4/1/96
L7	Group 1	PRG	CCS (VOCs, BNAs, anions, metals) detected at L7 are below the RGs. HI (0.01) was based on residential use scenario. The L7 groundwater is not considered to pose a threat to human health or the environment.	RI-PH1, 7/1/93, p. 5-367; BRA, 2/3/95, p.9-5; PRG 4/1/96
L8	Group 2	PRG	CCS are below the RGs and do not pose a threat to human health or the environment.	PRG, 4/1/96
L9	Group 3	RI-PH1	No contamination detected at site.	RI-PH1, 7/1/93, p5-451
L10	Group 3A	PRG	CCS are below the RGs and do not pose a threat to human health or the environment.	PRG, 4/1/96
L11	Test Site	RI-PH1	No contamination detected at site.	RI-PH1, 7/1/93, p6-15
L12	Doyle Lake	RI-PH1	No contamination detected at site.	RI-PH1, 7/1/93, p6-16
L13	Group 68	RI-PH1	No contamination detected at site.	RI-PH1, 7/1/93, p6-17
L15	Group 5	RI-PH1	No contamination detected at site.	RI-PH1, 7/1/93, p6-17,18
L16	Group 6	RI-PH1	No contamination detected at site.	RI-PH1, 7/1/93, p6-17,18

Site No.	Site Description	Which Phase Determined No Action?	Reason for NFA	Source of Information
L17	Group 7	RI-PH1	No contamination detected at site.	RI-PH1, 7/1/93, p6-17, 18
L18	Group 8	PRG	CCS are below the RGs and do not pose a threat to human health or the environment.	PRG, 4/1/96
L19	Group 9	PRG	CCS are below the RGs and do not pose a threat to human health or the environment.	PRG, 4/1/96
L20	Group 20	RI-PH1	No contamination detected at site.	RI-PH1, 7/1/93, p6-21
L21	Group 23	RI-PH1	No contamination detected at site.	RI-PH1, 7/1/93, p6-22
L22	Group 25	RI-PH1	No contamination detected at site.	RI-PH1, 7/1/93, p6-22
L23	Group 27	RI-PH1	No contamination detected at site.	RI-PH1, 7/1/93, p6-22
L23A	Group 27	RI-PH1	No contamination detected at site.	RI-PH1, 7/1/93, p6-22
L24	Group 29	RI-PH1	No evidence of contamination, based on historical review and site view.	RI-PH1, 7/1/93, p6-23
L25	Group 62	RI-PH1	No contamination detected at site.	RI-PH2, 7/1/93, p6-23
L26	Group 63	RI-PH1	No significant contamination found.	RI-PH1, 7/1/93, p6-23
L27	Group 64	RI-PH1	No site-related contaminants found	RI-PH1, 7/1/93, p6-23
L28	Group 65	RI-PH2	COCS (1,3-DND, anions, metals) are below the RGs and do not pose a threat to human health or the environment.	RI-PH1, 7/1/93, p5-709, RI-PH2, 12/5/94, p6-14
L29	Group 66	RI-PH1	No evidence of contamination, based on historical review and site view.	RI-PH1, 7/1/93, p6-24
L30	Group 66A	RI-PH1	No evidence of contamination, based on historical review and site view.	RI-PH1, 7/1/93, p6-24
L31	Extraction Pits	RI-PH1	No evidence of contamination, based on historical review and site view.	RI-PH1, 7/1/93, p6-25
L32	Group 60	RI-PH1	No evidence of contamination, based on historical review and site view.	RI-PH1, 7/1/93, p6-25
L33	PVC Area	RI-PH1	No contamination detected at site.	RI-PH1, 7/1/93, p6-25
L34	Former Burning Area	RI-PH1	No contamination detected at site.	RI-PH1, 7/1/93, p6-26
L35	Fill Area	RI-PH1	No contamination detected at site.	RI-PH1, 7/1/93, p6-26
M2	Explosive Burning Area	PRG	CCS are below the RGs and do not pose a threat to human health or the environment.	PRG, 4/1/96
M4	Lead Azide Area	PRG	CCS are below the RGs and do not pose a threat to human health or the environment.	PRG, 4/1/96
M6A	TNT Blocking Area	RI-PH2	Four monitoring wells (2 on M6A, 2 in perimeter) installed and sampled. CCS (metals, explosives) are below the RGs and does not pose a threat to human health or the environment.	RI-PH2, 5/30/93

Site No.	Site Description	Which Phase Determined No Action?	Reason for NFA	Source of Information
M9	Northern Ash Pile	PRG	CCS are below the RGs and do not pose a threat to human health or the environment.	PRG, 4/1/96
M10	Eastern Toluene Tank Farms	PRG	CCS are below the RGs and do not pose a threat to human health or the environment.	PRG, 4/1/96
M11	Landfill	PRG	CCS are below the RGs and do not pose a threat to human health or the environment.	PRG, 4/1/96
M12	Sellite Manufacturing Area	PRG	CCS are below the RGs and do not pose a threat to human health or the environment.	PRG, 4/1/96
M14	Former Pond Area	RI-PH2	Based on the RI-PH2 finding of no contaminants identified.	RI-PH2, 5/30/93, p6-18
M15	Sewage Treatment Plant	RI-PH2	Based on the RI-PH1 finding of no COCs and recommendation in RI PH2.	RI-PH1, 7/1/93, p6-13 RI-PH2, 5/30/93, p6-20
M16	Motor Pool Area	RI-PH2	Based on the RI-PH1 finding of no COCs and recommendation in RI PH2.	RI-PH2, 5/30/93, p6-20
M17	Laundry Facility	RI-PH2	Based on the RI-PH1 finding of no COCs and recommendation in RI PH2.	RI-PH2, 5/30/93, p6-21
M18	Herbicide Storage Area	RI-PH2	Based on the RI-PH1 finding of no COCs and recommendation in RI PH2.	RI-PH2, 5/30/93, p6-21

Key:

BNA	Base-Neutral-Acids (Semivolatiles)
BRA	Baseline Risk Assessment
COC	Contaminant of Concern
FS	Feasibility Study
HI	Hazard Index
PRG	Preliminary Remediation Goal
RG	Remedial Goal
RI-PH 1	Remedial Investigation, Phase 1
RI-PH2	Remedial Investigation, Phase 2
TPH	Total Petroleum Hydrocarbon
VOC	Volatile Organic Compound

[END OF SECTION]

7 DESCRIPTION OF ALTERNATIVES

The alternatives evaluated for the soil OU and the groundwater OU are described in this Section. The soil OU contains seven SRUs for which a total of 32 remedial alternatives were analyzed in detail. The groundwater OU contains three GRUs for which a total of 14 remedial alternatives were analyzed in detail. Some of these alternatives are common among the SRUs and GRUS. In addition, some alternatives have several common remedial actions (e.g., soil excavation). These common alternatives or actions are described once and referred to, when appropriate, under each SRU's or GRU's description. Exceptions from the general description are noted under each alternative's description,

7.1 Soil Operable Unit

7.1.1 Common-Soil Alternative Remedies

The No Action and the Institutional Controls alternatives are common to all SRUs.

7.1.1.1 Alternative 1: No Action

Under this alternative, the U.S. Army would take no action to prevent exposure to contaminated soil. The NCP and CERCLA as amended by SARA require that the No Action alternative be evaluated to establish a baseline for comparison of other alternatives, especially, in terms of cost and protection of human health and the environment. This alternative would neither eliminate norreduce the exposure of humans or the environment to the contaminants of concern,and the existing risk to humans and the environment would remain. There is no implementation time or cost associated with the No Action alternative because no additional remedial activities are implemented.

7.1.1.2 Alternative 2: Institutional Controls

The Institutional Controls alternative was developed to provideactions that may be taken to limit human exposure to the contaminated soil. This alternative is usually not effective at reducing the toxicity, mobility, or volume of contaminants, but it would reduce the probability of physical contact with the contaminated soil, thereby reducing risk to human health. The Institutional Controls alternative involves the following:

- Excavation that may cause plume migration or any other groundwater disturbance would be prohibited. These restrictions would be included in deed or leasing agreements.
- Fences and signs would be placed around all currently unfenced sites and an inspection and maintenance program of these fences and signs would be implemented.
- Risks associated with future land use would be specified in the deed, along with a calculation method that utilizes all available and relevant data and follows currently acceptable USEPA guidelines for human health risk assessments.
- Five-year review plan would be implemented. Five-year reviews are required by the NCP at all sites where hazardous chemicals remain at the site above levels that allow for unlimited use and unrestricted exposure. The review would present the analytical data and would include a determination of whether additional remedial actions are required at the sites under this SRU.

Natural attenuation processes are considered part of this alternative. Natural attenuation processes include biological degradation, dispersion, and dilution of contaminants. It should he noted that these processes are not effective for the types and concentrations of contaminants in soils present in the SRUs at JOAAP. Although this alternative would not result in the treatment of soil or the significant reduction of contaminant concentration, the Institutional Controls alternative would limit potential human exposure to the contaminants of concern, but would not mitigate localized environmental impacts.

7.1.2 Common Soil Actions

As previously mentioned, most of the alternatives have common operations. These actions are described below and then referenced later under the description of each alternative. Any deviation from the general description is noted under the description of each alternative.

7.1.2 1 Soil Excavation for Treatment or Disposal

Contaminated soil will be excavated from the various subareas within each site, loaded into trucks, and transported to a central treatment area for stockpiling. Conventional earthmoving equipment would be used for excavation. Soil excavation would continue until sampling confirms that concentration levels in the soil are below RG levels. If necessary, excavated areas would be backfilled for safety reasons and to avoid ponding of surface runoff with soil from an on-site borrow location. Some treated soil could also be used as clean backfill at any on-site location that does not require structural fill. Depending upon the time schedule for excavation, this may or may not be the same location from which the soil was removed. Backfilled areas would be regraded to conform tothe surrounding topography. Most of these backfilled areas would be revegetated with plants consistent with the future use of the area.

7.1.2.2 Confirmatory Sampling

The limits of excavation will be determined primarily based on the RI/FS maps and data and by visual observation of stained soil. These limits will be confirmed using field screening tests, in accordance with a sampling plan approved by the USEPA and IEPA, with final confirmatory samples (of contaminants of concern and TCLP analyses, as appropriate) analyzed at a laboratory.

7.1.2.3 Soil Transportation

It would be impractical and extremely expensive to establish a separate treatment area at each site in a SRU. Therefore, a central treatment area would be established in the MFG Area to process and bio-treat explosives contaminated soils because the majority of this contaminated soil is within the MFG Area. Trucks would be used to haul the soil to the treatment area. Trucks transporting soil from the LAP Area to the treatment area in the MFG Area may have to cross Illinois Route 53 and must comply with the Regulations of Illinois Department of Transportation.

7.1.2.4 Soil Preparation for Treatment

After reaching the treatment area, contaminated soil would be stored in a stockpile area. Soil would be blended and screened within the stockpile area, and any large stones, debris, and raw TNT will be removed using a series of shaker/separator units. Blending of hot-spot soil with less contaminated soil would be conducted, as necessary, to obtain a homogenized soil for feed into the treatment system.

Debris and large stones will be stockpiled for possible pressure washing and will be reused or properly disposed. Any raw TNT will be removed and stockpiled for open burn/detonation or incineration at a permitted facility, or processed to be blended back for treatment. All trucks used to transport soil will be routed through a wheel wash prior to exiting the treatment area. Wash water from the trucks and from the pressure wash operation will be containerized and used as makeup water in the treatment area or sent offsite for disposal. If unexploded ordnance (UXO) is encountered, it will be screened and removed for open bum/detonation or for off-site incineration at a permitted facility.

7.1.2.5 Soil Disposal

The Army will use the following options that exist for disposal of treated or untreated soils. Soils will be tested as appropriate and in accordance with procedures approved by USEPA and IEPA to determine whether the soils are RCRA hazardous wastes and whether RGs are exceeded. Based on the results of these tests, the disposal options for the soils will be as follows:

1. All soils which are contaminated with RCRA hazardous wastes must be:
   - Disposed at a RCRA Subtitle C facility, or
   - Treated and disposed at a RCRA Subtitle C facility, or
   - Treated and disposed at a RCRA Subtitle D facility or may be used as subgrade or backfill, if the soils are not characteristically hazardous under RCRA, achieve RGs, and do not exceed LDRs under RCRA.

2. All soils which exceed RGs and are not RCRA hazardous waste must disposed as above or:
   - Disposed at a RCRA Subtitle D facility, or
   - Used as subgrade fill material in capped landfills at JOAAP."

3. All remaining soils can be disposed as above, or
   - Reused (e.g., as backfill).

These options are available for all soils except the PCB-contaminated soils in SRU4. Applicable final rule-making under RCRA may amend this section.

7.1.3 SRU1: Explosives in Soil

Five alternatives were evaluated in detail in this SRU:

1. No Action *(Section 7.1.1.1)*;
2. Institutional Controls *(Section 7.1.1.2)*;
3. Bioremediation;
4. On-site Incineration; and
5. Excavation and Disposal

7.1.3.1 Alternative 3: Bioremediation

This alternative includes the following actions:

- Soil Excavation for Treatment or Disposal *(Section 7.1.2. 1)*;
- Confirmatory Sampling *(Section 7.1.2.2)*;
- Soil Transportation *(Section 7.1.2.3)*;
- Soil Preparation for Treatment *(Section 7.1.2.4)*;
- Bioremediation; and
- Soil Disposal *(Section 7.1.2.5)*.

7.1.3.1.1 Bioremediation Process

There are several ex-situ bioremediation technologies that are capable of meeting or substantially reducing concentrations of explosives below the RGs. Ex-situ bioremediation uses microorganisms under controlled conditions to degrade explosives contaminants in excavated soil, sludge, and solids. The microorganisms breakdown the explosives into non-toxic end products by using them as a food source. The end products typically are carbon dioxide ($C0_2$). Ex-situ bioremediation includes bioslurry phase bioremediation, in which the soils are mixed in water to form a slurry, and solid-phase bioremediation, in which the soils are placed in a cell or building and filled with added water andnutrients. Land farming and composting are types of solid phase bioremediation. To develop objective data on these technologies, the Army is sponsoring a Biotechnology Demonstration at the JOAAP starting in spring of 1998. In this demonstration, five vendors will each apply their technology to soils impacted with explosives. In addition, a large sample of JOAAP soils has been treated using bioslurry reactor and composting.

The final selection of bioremediation technology will be made based on several evaluation factors including cost, technical feasibility, performance time, environmental acceptability, and reuse of the final treated material. For the purpose of evaluation, the cost estimate for windrow composting was used as the bioremediation treatment process to be compared with other alternatives. This process has been proven on a full-scale operation. Composting is a treatment process where organic compounds are biologically degraded or transformed by mesophilic and thermophilic microorganisms, The composting process consists of mixing the waste material with an amendment or bulking agent to increase porosity, enhance air mass transfer into the system, and enhance the microbial population that degrades the contaminants. Windrow composting would include three major steps: (a) amendment materials preparation, (b) windrow construction, and (c) windrow operation.

71.3.2 Alternative 4: On-site Incineration

Incineration is the use of high temperatures ranging from 1,400 to 2,200ºF to volatilize and combust in the presence of oxygen organic components in contaminated soils. This alternative includes the following actions:

- Soil Excavation for Treatment and Disposal *(Section 7.1.2. 1)*;
- Confirmatory Sampling *(Section 7.1.2.2)*;
- Soil Transportation *(Section 7.1.2.3)*;
- Soil Preparation for Treatment *(Section 7.1.2.4)*;
- Incinerating Contaminated Soil; and
- Disposal of Incinerated Soil *(Sections 7.1.2.5 and 7.1.3.2.2)*.

7.1.3.2.1 Incineration Contaminated Soil

Incineration would consist of mobilizing a transportable thermal destruction unit with its associated air pollution reduction accessories. The specific type of process (e.g., rotary kiln or other) would be determined in the remedial design phase through engineering design and analysis and the competitive bidding process. Prior to the normal operation of the incinerator, a trial burn would be performed to satisfy the regulatory requirements for hazardous waste incineration (40 CFR 270. 19 and 270.62). The purpose of this trial burn would be to demonstrate the incinerator's capability to thermally destroy 99.99 percent of the explosives in the soil and also to demonstrate the performance of the air pollution control equipment. Normal operation of the incinerator would consist of 24 hours/day at an estimated feed rate of 20 to 30 tons of soil/hour. Normal operation of the incinerator would produce bottom ash (treated soil) from the incinerator, fly ash from the scrubber/baghouse assembly, and gaseous emission from the stack. Sampling would be conducted before, during, and at the conclusion of the incineration process. The performance objective of this technology is that the final concentrations of explosives in treated soils would meet the RG levels and comply with ARARs.

7.1.3.2.2 Disposal of Incinerated Soil

Incinerator ash (bottom ash and fly ash) can not be used as clean fill. It must be disposed in a landfill that meets the design requirements of 35 IAC 811 if it is non-hazardous, or 35 IAC 724 if it is hazardous. Treated soil or ash and the fly ash would be disposed at a RCRA Subpart D facility. It may be desirable to perform a treatability study to investigate appropriate amendments for the ash that will allow it to support plant growth. This would allow the use of ash as fill material for the excavated areas and then covering it with one foot of clean soil from an on-site borrow location. For the purpose of cost evaluation, it was assumed that the ash would be disposed at a permitted landfill.

7.1.3.3 Alternative 5: Excavation and Disposal

This alternative includes the following actions:

- Soil Excavation for Treatment or Disposal (*Section 7.1.2.1*);
- Confirmatory Sampling (*Section 7.1.2.2*); and
- Soil Disposal (*Section 7.1.2.5*).

<u>7.1.4 SRU2: Metals in Soil</u>

Four alternatives were evaluated in detail in this SRU:

1. No Action (*Section 7. 1. 1.1*);
2. Institutional Controls (*Section 7.1.1.2*);
3. Stabilization/Solidification; and
4. Excavation and Disposal.

7.1.4.1 Alternative 3: Stabilization/Solidification

This alternative includes the following actions:

- Soil Excavation for Treatment or Disposal (*Section 7.1.2.1*);
- Confirmatory Sampling (*Section 7.1.2.2*);
- Soil Transportation (*Section 7.1.2.3*);
- Soil Preparation for Treatment (*Section 7.1.2.4*);
- Solidification/stabilization of Contaminated Soil; and
- Soil Disposal (*Section 7.1.2.5*).

7.1.4.1.1 Solidification/Stabilization of Contaminated Soil

The Solidification/Stabilization process involves mixing the contaminated soil with binding agents to reduce the mobility of the contaminants of concern (stabilization) and to improve the soil handling and physical characteristics of the soil (solidification). A wide variety of solidification/stabilization processes are available, along with an array of additives that may enhance the process and the finished product. Prior to the final design of the solidification/stabilization alternative, a treatability study would be required. This study would select the most appropriate binders for the contaminants, and test these binders to select the one, along with any additives, that provides the optimum solidified product. The study can also provide details on the strength, durability, resistance to leaching, and volume increase that can be expected of the solidified waste. For cost estimate purposes, it has been assumed that Portland cement and sodium silicate would be used as binding agents. The performance objectives of this technology is to bind the contaminants in a matrix so that contaminants would not leach in concentrations in excess of RGs and TCLP limits.

Binders and additives would be added to the soil in appropriate ratios based on the treatability study. Soil and the binders/additives would then be thoroughly mixed in a mixer, poured into constructed forms (e.g., 1-meter square blocks) and test forms, and allowed to cure until the desired hardness is achieved before final disposal. Test forms would be analyzed using TCLP test and/or other tests to determine the acceptability of the solidified/stabilized material. When confirmation is received that the solidified waste meets all requirements, the solidified material will be stockpiled for subsequent transportation and disposal.

7.1.4.2 Alternative 4: Excavation and Disposal

This alternative includes the following actions:

- Soil Excavation for Treatment or Disposal (*Section 7.1.2.1*);
- Confirmatory sampling (*Section 7.1.2*); and
- Soil Disposal (*Section 7.1.2.5*).

7.1.5 SRU3: Explosives and Metals in Soil/Sediment

Five alternatives were evaluated in detail in this SRU:

1. No Action *(Section 7.1.1.1)*;
2. Institutional Controls (*Section 7.1.1.2*);
3. Bioremediation and Disposal;
4. On-site Incineration; and
5. Excavation and Disposal.

7.1.5.1 Alternative 3: Bioremediation and Disposal

This alternative includes the following actions:

- Soil Excavation for Treatment or Disposal (*Section 7.1.2.1*);
- Confirmatory Sampling (*Section 7.1.2.2*);
- Soil Transportation (*Section 7.1.2.3*);
- Soil Preparation for Treatment (*Section 7.1.2.4*);
- Bioremediating explosives contaminated soil (*Section 7.1.3. 1.1*); and
- Soil Disposal (*Section 7.1.2.5*).

7 1.5.2 Alternative 4: On-site Incineration

Incineration is the use of high temperatures ranging from 1,400 to 2,200ºF to volatilize and combust (in the presence of oxygen) organic components in contaminated soils. This alternative includes the following actions:

- Soil Excavation for Treatment or Disposal (*Section 7.1.2.1*);
- Confirmatory Sampling (*Section 7.1.2.2*);
- Soil Transportation (*Section 7.1.2.3*);
- Soil Preparation for Treatment (*Section 7.1.2.4*);
- Incinerating Contaminated soil (*Section 7.1.3.2.1*); and
- Disposal of Incinerated Soil (*Sections 7.1.2.5 and 7.1.3.2.2*).

7.1.5.3 Alternative 5: Excavation and Disposal

This alternative includes the following actions:

- Soil Excavation for Treatment or Disposal (*Section 7.1.2.1*);
- Confirmatory Sampling (*Section 7.1.2.2*); and
- Soil Disposal (*Section 7. 1.2.5*).

7.1.6 SRU4: PCBs in Soil

Five alternatives were evaluated in detail in this SRU:

- No Action (*Section 7.1.1.1*);
- Institutional Controls (*Section 7.1.1.2*);
- Chemical Dehalogenation;
- On-site Low-temperature Thermal Desorption; and
- Excavation/Incineration and Disposal.

7.1.6.1 Alternative 3: Chemical Dehalogenation

This alternative includes the following actions:

- Soil Excavation for Treatment or Disposal (*Section 7.1.2.1*);
- Confirmatory Sampling (*Section 7.1.2.2*);
- Soil Transportation;
- Soil Preparation for Treatment (*Section 7.1.2.4*);

- Chemical Dehalogenation of contaminated soil; and
- Disposal of Treated Soil (*Section 7.1.6.1.3*).

7.1.6.1.1 Soil Transportation

A centralized chemical dehalogenation treatment area would be established within the LAP area with sufficient room to construct and operate treatment units and stockpile facilities. Trucks would haul the soil to the treatment area on existing roads.

7.1.6.1.2 Chemical Dehalogenation

Several chemical dehalogenation processes are available for treating PCBs in soil. For cost estimating purpose, the Galson Research Corporation (GRC) process is selected. This is a relatively new low temperature (230 - 320ºF) process that replaces the chlorine molecule in PCB with a glycol structure. The process results in clean soil, although small quantities of glycol may remain in the soil. Glycol, a biodegradable food additive, should rapidly degrade in the environment with no adverse effects. A treatability study to demonstrate the effectiveness of this process would be required. to comply with TSCA regulations, permission from USEPA regional administrator will be required to use this technology to treat soils with concentrations exceeding 500 ppm.

7.1.6.1.3 Disposal of Treated Soil

When confirmation is received that PCB levels are below RGs, the treated soil would be reused or properly disposed.

7.1.6.2 Alternative 4: On-site Low-temperature Thermal Desorption (LTTD)

This alternative includes the following actions:

- Soil Excavation for Treatment and Disposal (*Section 7.1.2.1*);
- Confirmatory Sampling (*Section 7.1.2.2*);
- Soil Transportation (*Section 7.1.2.3*);
- Soil Preparation for Treatment (*Section 7.1.2.4*);
- Soil Treatment Using an LTTD Unit; and
- Disposal of Treated Soil (*Section 7.1.6.1.3*).

7.1.6.2.1 Soil Treatment Using an LTTD-Unit

LTTD is a process that will remove PCBs from soil by heating and desorbing them from the soil particles. The PCBs are not destroyed, they are condensed and collected for off-site disposal (most likely incineration) at a permitted facility. The LTTD will require trial burns to assure that the operating parameters are adequate to remove the PCBs and that pollution control devices are adequate to prevent releases of contaminants at levels above regulatory limits. To comply with TSCA, permission from USEPA regional administrator will be required to use this technology to treat soil with concentrations exceeding 500 ppm.

7.1.6.3 Alternative 5: Excavation/Incineration and Disposal

This alternative includes the following actions:

- Soil Excavation for Treatment or Disposal (*Section 7.1.2.1*);
- Confirmatory Sampling (*Section 7.1.2.2*); and
- Off-site Incineration or Soil Disposal.

7.1.6.3.1 Off-site Incineration or Soil Disposal

Depending on confirmatory sampling results, this alternative is broken down into three different steps:

- If PCB levels in soil are below 50 ppm, then the soil would be disposed at the future proposed WCLF or at a permitted facility (estimated volume = 956 CY),
- If PCB levels in the soil are between 50 ppm and 500 ppm, then the soil wouldbe disposed in a TSCA permitted landfill estimated volume = 626 CY), and
- If PCB levels are greater than 500 ppm, then the soil would be disposed off-site in accordance with TSCA (e.g., treated off-site at a TSCA permitted incinerator) (estimated volume = 1,833 CY).

Excavated areas would be backfilled with clean fill obtained from an on-site borrow location and revegetated with plants consistent with the future use of the area

7.1.7 SRU5: Organics in Soil

Six alternatives were evaluated in detail in this SRU:

1. No Action (*Section 7.1.1.1*);
2. Institutional Controls (*Section 7.1.1.2*);
3. Bioremediation (*Section 7.1.3.1*) (Centralized treatment facility would be at a location within the LAP Area);
4. Solvent Extraction;
5. On-site Low-temperature Thermal Desorption; and
6. Excavation and Disposal.

7.1.7.1 Alternative 4: Solvent Extraction

This alternative includes the following actions:

- Soil Excavation for Treatment or Disposal (*Section 7.1.2.1*);
- Confirmatory Sampling (*Section 7.1.2.2*);
- Soil Transportation;
- Soil Preparation for Treatment (*Section 7.1.2.4*);
- Solvent Extraction ; and
- Soil Disposal (*Section 7.1.2.5*).

7.1.7.1.1 Soil Transportation

It would be impractical and expensive to establish separate solvent extraction treatment areas at each site in SRU5. For cost estimating purposes, the treatment area is considered to be within site Ll. Trucks would be used to haul the soil to the treatment area using the existing roads.

7.1.7.1.2 Solvent Extraction

Several solvent extraction processes are available for treating organics in soil. All of these systems operate on the same basic principle. First, a solvent is used that extracts both water and organics from the soil into the liquid phase. This liquid phase is then separated from the solids. Then the water and the organics phase are separated. Finally, the contaminants are separated from the solvent and disposed at a permitted facility. A treatability study will be required to develop operational parameters.

7.1.7.2 Alternative 5: On-site Low-Temperature Thermal Desorption

This alternative includes the following actions:

- Soil Excavation for Treatment or Disposal (*Section in 7.1.2.1*);
- Confirmatory Sampling (*Section 7.1.2.2*);
- Soil Transportation (*Section 7.1.2.3*);
- Soil Preparation for Treatment (*Section 7.1.2.4*);
- Soil Treatment Using a Low-Temperature Thermal Desorption Unit; and

- Soil Disposal (*Section 7.1.2.5*).

7.1.7.2.1 Soil Treatment Using a Low-Temperature Thermal Desorption Unit;
LTTD is a process that will remove organics from soil by heating and desorbing them from the soil particles. The organics are not destroyed, rather they are condensed and collected for off-site disposal (most likely incineration) at a permitted facility. The LTTD will require trial burns to prove that the operating parameters are adequate to remove the organics, and that pollution control devices are adequate to prevent releases of contaminants at levels above regulatory limits.

7.1.7.3 Alternative 6: Excavation and Disposal
This alternative includes the following actions:
- Soil Excavation for Treatment or Disposal (*Section 7.1.2.1*);
- Confirmatory Sampling (*Section 7.1.2.2*); and
- Soil Disposal (*Section 7.1.2.5*).

7.1.8 SRU6: Landfills
Four alternatives were evaluated in detail in this SRU:
- No Action (*Section 7.1.1.1*);
- Institutional Controls (*Section 7.1.1.2*);
- Capping; and
- Excavation and Disposal.

7.1.8.1 Alternative 3: Capping
This alternative includes the following actions:
- Surface Regrading;
- Cap Construction; and
- Establishment of a Maintenance/Repair and Monitoring Program.

7.1.8.1.1 Surface Regrading
Existing landfill surfaces need to be filled, graded, and properly contoured prior to construction of the cap. Grading may require fill soil from an on-site borrow location, appropriate untreated soil from another SRU (e.g., SRU2), or the product of a treatment process. Conventional earthmoving equipment would be used for grading.

7.1.8.1.2 Cap Construction
This alternative involves the construction of RCRA Subtitle D caps over landfills containing nonhazardous wastes (M13) and RCRA Subtitle C caps over landfills containing hazardous wastes (site M 11 and L3). These caps would be designed and constructed to minimize infiltration or precipitation and to also prevent human exposure to contaminated materials in the landfills. The details of each cap would be presented in the design phase; however, each cap would be constructed of different layers and graded to prevent infiltration and establish proper grades and slopes for good run-off and erosion control. The top layer will be revegetated with shallow-rooted vegetation that would be compatible with the intended land use.

7.1.8.1.3 Establishment of Maintenance/Repair and Monitoring Program
A maintenance/repair and monitoring program would be required after capping and closing the landfills. A maintenance/repair program would be established to maintain the caps and prolong their life span. The monitoring program would be established to test and monitor the groundwater beneath and around the

landfills. This program will be in place to detect if any contaminants are migrating from the landfills into the groundwater.

7.1.8.2 Alternative 4: Excavation and Disposal

This alternative includes the following actions:

- Landfill Excavation;
- Waste Testing and Segregation; and
- Waste Disposal.

7.1.8.2.1 Landfill Excavation

Landfill material from sites L4, M1, and M9 would be excavated using conventional earthmoving equipment. Excavated areas would be graded and vegetated to be compatible with the intended land use. If necessary, excavated areas would be backfilled from an on-site borrow location. Excavated material would be tested prior to final disposal.

7.1.8.2.2 Waste Testing and Segregation

Based upon testing, excavated material would be classified and segregated as hazardous, non-hazardous, or recyclable. Based upon the classification, trucks would transport the waste for ultimate and appropriate disposal.

7.1.8.2.3 Waste Disposal

Excavation and disposal would prevent human exposure to waste, prevent migration of contaminants, and comply with State and Federal regulations for landfill closure. If excavated materials are determined to be hazardous, then they would be disposed at a RCRA Subtitle C landfill. If waste materials are determined to be non-hazardous, they would be disposed at the future proposed WCLF or at an off-site existing permitted facility. The Army has determined that the ash at M1 and M9 is not a RCRA hazardous waste and can be placed in a solid waste disposal facility. The IEPA supports the Army determination that the M1 and M9 also is a not a RCRA hazardous waste (IEPA, 1998).

7.1.9 SRU7: Sulfur

Three alternatives were evaluated in detail in this SRU:

- No Action (*Section 7.1.1.1*);
- Institutional Controls (*Section 7.1.1.2*); and
- Removal and Recycle or Disposal.

7.1.9.1 Alternative 3: Removal and Recycle or Disposal

The raw sulfur found on the surface in study areas M8 and M12 would be excavated and separated from the soils at the site. The sulfur may be determined to have some commercial value and could be sold or recycled. The U.S. Army has investigated and is still investigating the possibility of selling sulfur. However, if the raw sulfur has no commercial value, it would be disposed at RCRA Subpart D facility as a non-hazardous waste. The removal of sulfur is not regulated under CERCLA.

7.2 Groundwater Operable Unit

7.2.1 Common Groundwater Alternatives

The No Action, Limited Action, and Pump and Treat alternatives are common to all GRUs. The implementation of these alternatives within each GRU may slightly differ. These differences are noted under the description of alternatives for each GRU. Each alternative will be enhanced by the source (i.e., contaminated soil) removal within the soil OU. Each alternative will also experience natural attenuation processes that will enhance the degradation rate of contaminated groundwater plumes.

7.2.1.1 Alternative 1: No Action

The No Action alternative means that no remedial activities would be performed in the GRU to reduce impacts to contaminated groundwater. The inclusion of the No Action alternative is a requirement of CERCLA and is used as a basis for comparison to other alternatives. The only changes that may occur to the contaminant concentrations would be due to natural processes of attenuation such as adsorption of chemicals onto soils, biodegradation, and dilution. These processes do not require implementation activities. Natural attenuation is not monitored as part of the No Action alternative. Under the No Action alternative, the effectiveness or ineffectiveness of natural attenuation cannot be determined.

7.2.1.2 Alternative 2: Limited Action

Under the Limited Action alternative, steps are taken to prevent or limit the likelihood of human consumption or exposure to contaminated groundwater, and natural attenuation is used to lower the concentrations of contaminants in the groundwater. The Limited Action alternative includes establishment of a Groundwater Management Zone (GMZ), deed and zoning restrictions, periodic site inspections, groundwater and surface water monitoring, and natural attenuation. This alternative also includes contingency plans should the alternative prove ineffective.

Natural attenuation involves the use of natural processes such as biological degradation, sorption, dispersion, and dilution to reduce the concentrations of contaminants in the plumes. Cleanup of contaminated soil will also serve to eliminate the continuing source of groundwater contamination. Natural attenuation may be enhanced by the use of plants whose root systems can be used to uptake groundwater and remediate explosives. This process, called phytoremediation, is currently being studied at JOAAP (Site L1), and the results of this study may be used to assess the effectiveness of this process and the benefits of enhancing natural attenuation with this process. Results of this study will be available for use during the RD phase.

GMZs are required by Illinois regulations to identify areas that do not meet drinking water standards until cleanup activities are complete. GMZs would also be used to delineate the areas where restrictions on groundwater use and uncontrolled soil excavation would be necessary to prevent human contact with groundwater. The GMZs would comprise both the glacial drift and shallow bedrock aquifers, and would cover the areas shown in Figure 4. The GMZs would be established with sufficient buffers to allow groundwater wells to be installed outside their borders. These restrictions would be attached to land deeds or leasing agreements.

A groundwater monitoring program would be implemented to track changes in concentration and detect plume migration. Data from the monitoring program would be used in a groundwater model to predict and anticipate the rate of contaminant reduction. The groundwater monitoring and modeling would commence prior to the removal of contaminated soils in sites impacting groundwater in order to establish baseline data for evaluating the effect of source removal on groundwater concentrations and the effectiveness of natural attenuation. The groundwater data would be reviewed annually, and a five-year assessment conducted to evaluate progress until RGs are achieved.

Once concentrations drop below the RGs, institutional controls would be modified so that additional activities are allowed. If groundwater plumes migrate beyond the boundaries of the established GMZs, groundwater is discharged to surface water at concentrations that exceed the water quality criteria established for JOAAP, at the boundaries of the GMZs, or the natural attenuation process proves ineffective, a contingency plan involving phytoremediation would be implemented. If phytoremediation proves ineffective, then a contingency plan involving the pumping and treating of groundwater will be implemented.

7.2.2 Common Groundwater Actions

As previously mentioned, some of the alternatives have common actions. These actions are described below and then referenced later under the description of each alternative. Any deviations from the general description are noted under the description of each alternative. These common actions are:

- Groundwater pumping;
- Treatment using Activated Carbon;
- Establishment of GMZs, deed and excavation restrictions, water monitoring and modeling; and
- Removal of metals by precipitation.

7.2.2.1 Groundwater pumping

The recovered groundwater from all sites will be extracted using wells or trenches and piped to an aboveground holding tank sized for each site. Because of the high natural mineral content of the groundwater, a pretreatment system will likely be required to prevent the deposition of minerals within the treatment system that may result in reduced efficiency or clogging.

7.2.2.2 Treatment Using Activated Carbon

The effluent from the pretreatment would flow to one or more pairs of activated carbon units, where the contaminants will be sorbed. The first-vessel within the unit is the primary cell, while the second vessel serves as the polishing cell. Effluent from both cells would be sampled and analyzed for contaminants to monitor breakthrough. Once the breakthrough is detected, spent carbon in the primary cell will be replaced with virgin carbon while the polishing cell becomes the primary cell. After carbon is replaced, this cell will be returned to operation serving as the polishing cell. A licensed contractor will periodically replace spent carbon. The spent carbon will be transported off site for disposal at a permitted facility or recycled. The treated water will be discharged to the local surface water or injected back into the aquifer.

7.2.2.3 Establishment of GMZs, deed and excavation restrictions, water monitoring and modeling

Described as part of Alternative 2: Limited Action under Section 7.2.1.2.

7.2.2.4 Removal of Metals by Precipitation

The pH of the contaminated groundwater will beadjusted to above 11.0 by addition of time. Metals will then be removed by precipitation. Prior to disposal, the metal sludge will be dewatered. The metal sludge will be disposed at the appropriate landfill.

7.2.3 GRU1: Explosives in Groundwater - LAP Area

Three alternatives were evaluated in detail in this GRU:

1. No Action (*Section 7.2.1.1*);
2. Limited Action (*Section 7.2.1.2*); and
3. Pump and Treat by Carbon Adsorption.

7.2.3.1 Alternative 3: Pump and Treat by Carbon Adsorption

This alternative includes the following actions:

- Groundwater Pumping (*Section 7.2.2.1*);
- Treatment using Activated Carbon (*Section 7.2.2.2*);
- Discharge of Treated Water; and

- Establishment of GMZs, Deed and Excavation Restrictions, Water Monitoring and Modeling (*Section 7.2.2.3*).

7.2.3.1.1 Discharge of Treated Water

Discharge to Prairie Creek was identified as the only technically feasible and implementable process option for the discharge of treated water for GRU 1. The injection and aquifer recharge options of treated water were unfeasible due to the relatively low hydraulic conductivity of the LAP area soils.

7.2.4 RU2: Explosives and Other Contaminants in Groundwater - MFG Area

Five alternatives were evaluated in detail in this GRU:

1. No Action (*Section 7.2.1.1*);
2. Limited Action (*Section 7.2.1.2*);
3. Pump and Treat with Bioreactor;
4. Pump and Treat by Carbon Adsorption; and
5. Pump and Treat by UV Oxidation/Carbon Adsorption.

7.2.4.1 Alternative 3: Pump and Treat with Bioreactor

This alternative includes the following actions:

- Groundwater Pumping (*Section 7.2.2.1*);
- Establishment of GMZs, Deed and Excavation Restrictions, Water Monitoring and Modeling (Section 7.2.2.3);
- Removal of Metals by Precipitation (*Section 7.2.2.4*); and
- Treatment with Bioreactor

7.2.4.1.1 Treatment with Bioreactor

The effluent from the pretreatment would be pumped through pipelines equipped with static mixers. Sodium nitrate and molasses would be added into this line to serve, respectively, as the electron acceptor and co-substrate during the anoxic biodegradation process. Powder activated carbon would be suspended in the bioreactor and will sorb the organic compounds in the groundwater. Air would be introduced to the system through a series of diffusers installed at the bottom of the bioreactor. A polymer would be added to the effluent from the bioreactor to facilitate settling of the sludge and powdered activated carbon. The solids in the settling tank would settle and recycle back to the system. The excess sludge would be drummed and disposed. The treated water would be discharged to the local surface water or injected into the aquifer.

7.2.4.2 Alternative 4: Pump and Treat by Carbon Adsorption

This alternative includes the following actions:

- Groundwater pumping (*Section 7.2.2.1*);
- Removal of metals by precipitation (*Section 7.2.2.4*);
- Treatment using Activated Carbon (*Section 7.2.2.2*); and
- Establishment of GMZs, deed and excavation restrictions, water monitoring and modeling (*Section 7.2.2.3*).

7.2.4.3 Alternative 5: Pump and Treat by Ultra Violet (UV) 0xidation/Carbon Adsorption

This alternative includes the following actions:

- Groundwater Pumping (*Section 7.2.2.1*);
- Removal of Metals by Precipitation (*Section 7.2.2.4*);
- Treatment of Water by UV Oxidation;

- Treatment of Water by Activated Carbon Prior to Discharge; and
- Establishment of GMZs, Deed and Excavation Restrictions, Water Monitoring and Modeling (*Section 7 2.2.3*).

7.2.4.3.1 Treatment of Water with UV Oxidation

After pretreatment, water would be pumped to a UV oxidation reactor equipped with an H_20_2 dosing system. UV lamps would be used to provide the UV radiation that would split the H_20_2 molecule, producing the very reactive hydroxyl radicals needed for effective breakdown of the contaminants.

7.2.4.3.2 Treatment of Water by Activated Carbon Prior to Discharge

UV oxidation treatment of contaminated groundwater will remove up to 90 percent of explosives. A net increase of TNB concentration will be expected due to the partial breakdown of TNT. The carbon polishing cells will then remove this TNB along with the other residual contaminants. A pair or more of carbon cells will be installed in series to further remove the contaminants from the groundwater before the discharge. Once the breakthrough is detected, spent carbon in the primary cell will be replaced with virgin carbon while the polishing cell becomes the primary cell. After carbon is replaced, this cell will be returned to operation serving as the polishing cell. Periodic carbon replacement will be required. The spent carbon will be transported off-site for disposal at a permitted facility or recycled. The treated water will be discharged to the local surface water or injected into the aquifer.

7.2.5 GRU3: Volatile Organic Compounds (VOCs) in Groundwater - MFG Area

Six alternatives were evaluated in detail in this GRU:

1. No Action *(Section 7.2.1.1*);
2. Limited Action (*Section 7.2.1.2*);
3. In-Situ Bioremediation;
4. Pump and Treat by Air Stripping/Vapor-Phase Carbon Adsorption;
5. Pump and Treat by Carbon Adsorption; and
6. Pump and Treat by UV Oxidation.

7.2.5.1 Alternative 3: In-Situ Bioremediation

This alternative includes the following actions:

- Establishment of GMZs, Deed and Excavation Restrictions, Water Monitoring and Modeling (*Section 7.2.2.3*); and
- In-situ Bioremediation.

7.2.5.1.1 In-Situ Bioremediation

In this alternative, an in-situ bioremediation process would treat the contaminated groundwater. To achieve the natural biodegradation process, air or oxygen would be supplied by a series of pumps and injection wells to the contaminated aquifer using microbubbles to oxygenate the aquifer. If required, nutrients would also be injected.

7.2.5.2 Alternative 4: Pump and Treat by Air Stripping/Vapor-Phase Carbon Adsorption

This alternative includes the following actions:

- Groundwater Pumping (*Section 7.2.2.1*);
- Treatment of Water with Air Stripping/vapor-phase Carbon Adsorption Treatment System;
- Establishment of GMZs, Deed and Excavation Restrictions, Water Monitoring and Modeling (*Section 7.2.2.3*).

7.2.5.2.1 Treatment of Water by Air Stripping/vapor-phase Carbon Adsorption Treatment System
The extracted contaminated groundwater would be pumped to an aboveground air stripping treatment system for removal of the BTEX. The water would be pumped to an air-stripping tower. Air would be blown into the tower countercurrently to the water flow. The BTEX in the water would then be transferred to the air stream and exit for the top of the tower. A vapor-phase carbon cell will be used to remove residual contaminants from the exit gas prior to atmospheric discharge, The effluent from the carbon cell would be sampled to monitor breakthrough. Spent carbon would be transported off site for disposal at an approved hazardous waste facility. The treated water would be discharged to the local surface water or injected into the aquifer.

7.2.5.3 Alternative 5: Pump and Treat by Carbon Adsorption
This alternative includes the following actions:

- Groundwater Pumping (*Section 7.2.2.1*);
- Treatment Using Activated Carbon (*Section 7.2.2.2*); and
- Establishment of GMZs, Deed and Excavation Restrictions, Water Monitoring and Modeling (*Section 7.2.2.3*).

7.2.5.4 Alternative 6: Pump and Treat by UV Oxidation
This alternative includes the following actions:

- Groundwater Pumping (*Section 7.2.2.1*);
- Treatment of Water by UV Oxidation (*Section 7.2.4.3*); and
- Establishment of GMZs, Deed and Excavation Restrictions, Water Monitoring and Modeling (*Section 7.2.2.3*).

[END OF SECTION]

8. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

This section evaluates and compares each of thealternatives described in Section 7.0 with respect to the nine criteria used to assess remedial alternatives as outlined in Section 300.430(e) of the NCP.

8.1 Nine Evaluation Criteria

Section 300.430(e) of the NCP lists nine criteria by which each remedial unit alternative must be assessed. The acceptability and performance of each alternative against the criteria is evaluated individually so that relative strengths and weaknesses may be identified. The Threshold Criteria must be satisfied in order for an alternative to be eligible for selection. The Balancing Criteria are used to weigh major tradeoffs among alternatives. The Modifying Criteria are based on public comment received on the Proposed Plan.

The remedial alternatives are evaluated against the following criteria for final actions. Similarly, the remedial alternatives are evaluated against the following criteria for interim actions, recognizing that the actions taken may not be the final actions.

Threshold Criteria

1. ***Overall Protection to the Human Health and the Environment*** addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.
2. ***Compliance with Applicable or Relevant and Appropriate Requirements*** addresses whether or not a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes and/or provide grounds for invoking a waiver.

Balancing Criteria

3. ***Long-term Effectiveness and Permanence*** refers to the magnitude of residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time once the cleanup goals have been met.
4. ***Reduction of Toxicity, Mobility, or Volume through Treatment*** is the anticipated performance of the treatment technologies that may be employed in a remedy.
5. ***Short-term Effectiveness*** refers to the speed with which the remedy achieves protection, as well as the remedy's potential to create adverse impacts on human health and the environment that may result during the construction and implementation period.
6. ***Implementability*** is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement the chosen solution.
7. ***Cost*** includes total, capital, annual operation and maintenance, and site closeout costs. [Total costs are discounted (at an annual rate of 7%) to net present value (NPV) in order to provide a standard basis of comparison across alternatives. Allother costs are shown in current year dollars relative to when they occur. Calculation of NPV is in accordance with standard economic procedures. Tables 8-1 through 8-12 and the text show total costs (in NPV) for all SRUs and GRUs. Table 8-13 and Appendix B provide more detailed breakdown of the component costs. All costs are rounded as appropriate.]

Modifying Criteria

8. ***State Acceptance*** indicates whether, based on its review of the RI/FS and Proposed Plan, the State concurs with, opposes, or has no comment on the preferred alternative.
9. ***Community Acceptance*** is assessed following a review of the public comments received on the Proposed Plan.

8.2 Soil Operable Unit

8.2.1 SRU1: Explosives in Soil

The alternatives evaluated for this SRU are:

- Alternative 1: No Action
- Alternative 2: Institutional Controls
- Alternative 3: Bioremediation
- Alternative 4: On-site Incineration
- Alternative 5: Excavation and Disposal

SRU1 includes both interim and final remedial actions. Following is a summary of the comparative analysis of these alternatives.

Overall Protection to the Human Health and the Environment

Alternative 1 would not protect human health and the environment becauseno action would be taken to eliminate, reduce or control exposure pathways. In addition, this alternative does not remove any soil, which is a probable source for groundwater contamination. Therefore, Alternative 1 does not meet this criterion.

Alternative 2 would provide some protection from contaminated soil by implementing restrictions such as fencing around contaminated areas and deed restrictionson excavation within these contaminated areas. Although these restrictions reduce access and potential exposure to contaminated areas, they do not remove contaminated soil, which is the probable source of groundwater contamination. In addition, natural attenuation processes in the InstitutionalControls alternative are not effective for high concentrations of explosives in soils. For theses reasons, Alternative 2 does not meet this criterion.

The remaining alternatives are considered to be protective to human health and the environment because they eliminate or reduce the source by the removing the contaminated soil. The remedial actions reduce the short- and long-term risks to ecological populations by reducing their exposure and uptake of contamination via soil and food. Alternatives 3, 4 and 5 provide overall protection to human health and the environment for final remedial actions by removing contaminated soil to meet RGs. In addition, these alternatives eliminate or reduce the potential for contaminant migration. The risks are reduced by treatment for Alternatives 3 and 4. The risks are reduced by engineering controls (disposal in a landfill) for Alternative 5.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

With the exception of Alternatives 1 and 2, all the alternatives will comply with the ARARs. The acceptable alternatives will either reduce exposure to contaminated soil , remove and treat soil, or remove contaminated soil to a controlled location.

Long-term Effectiveness and Permanence

Alternatives 1 and 2 partially meet this criterion. These two alternatives will only slightly decrease the risk to human health and the environment vianatural attenuation. Deed restrictions and the risk management strategies under Alternative 2 will also reduce the potential for human exposure. However, under both alternatives, the continued presence and migration of the contaminants may pose future risk to the environment.

Alternatives 3 and 4 provide the most permanent solution since contaminants are treated to meet RGs. It should be noted that Alternative 5 would not be effective if the disposal landfill falls. However, the landfill will be in compliance with RCRA and is designed to minimize the possibility of failure.

Residual risks associated with interim actions will be addressed with implementation of final remedial action.

Reduction of Toxicity, Mobility, or Volume through Treatment
Alternatives 1 and 2 would not provide any active reduction of toxicity, mobility, or volume of the contaminants because removal or treatment of the contaminated soil would not be components of these two alternatives. Alternatives 3 and 4 permanently reduce the toxicity, mobility of contaminants by removing and treating them. Therefore, these two alternatives fully meet this criterion. However, if composting is implemented as the biological treatment process, the volume of treated material will be greater than the original volume of contaminated soil.

Alternative 5 partially meets this criterion. This alternative reduces the mobility of the contaminants by removing the contaminated media from the site and containing them in a landfill. However, this alternative is not preferable to the treatment alternatives because it does not satisfy the statutory preference for treatment.

Short-term Effectiveness
Alternative 1 does not meet the RG criterion. Minimal site activities are performed under Alternative 2, thus limiting the short term impact to workers. However, the rate of natural attenuation is likely to be slow. Therefore, this alternative partially meets this criterion.

Since Alternatives 3 activities are conducted on-site, the community will not be subjected to any short-term impacts due to the remedial actions. However, there is a potential for workers to physical hazard exposure and a potential impact to the environment as a result of erosion during excavation activities.

Alternative 4 poses potential short-term impacts from the physical hazards associated with operating the incinerator and air pollutant transport in case of air pollution control equipment failure. There is a potential for workers exposure and a potential short-term impact to the environment as a result of erosion during excavation activities. Alternative 5 may have a short-term impact on the community and the environment due the off-site transportation of contaminated soil and the possibility of landfill failure.

Implementability
Alternatives 1 and 2 would be the most easily implemented. Alternative 1 would require no technical action, and Alternative 2 would require minimal action. Implementation of Alternatives 3 and 4 would mainly consist of excavation, treatment, and disposal. Alternative 5 would not require treatment. Technically, no significant constraints are anticipated for implementing any of these three alternatives. Administratively, there may be a long duration in meeting the necessary procedural requirements to implement Alternative 4. In addition, implementation of Alternative 4 may involve extensive public hearings and may face difficulty in gaining public acceptance.

Cost
The following estimated cost includes capital, operational, and maintenance for each alternatives. These are present worth costs and are adjusted for the length of time to complete each alternative.

Alternative 1:	No Action	$ 0
Alternative 2:	Institutional Control	$ 3,000,000
Alternative 3:	Bioremediation	$ 39,300,000
Alternative 4:	On-site Incineration	$ 76,600,000
Alternative 5:	Excavation and Disposal	$ 23,100,000

State Acceptance
The State of Illinois concurs with the acceptability of Alternatives 3, 4, and 5 based on these alternatives complying with the ARARs. The IEPA prefers Alternative 3: Bioremediation.

Community Acceptance
Comments received during the Public review period and from the January 8, 1998, Public Meeting were transcribed and are included in the Responsiveness Summary of this document. Responses to these comments are also included in the Responsiveness Summary. Generally, these comments were positive in nature. There is a concern and request from the community to expedite the remediation process. In general, the community has a preference for treating the contamination and appears to concur with the selected remedy.

8.2.1.1 Summary Evaluation of Alternatives for SRU1
Table 8-1 compares the alternatives considered for SRUI with respect to the nine CERCLA evaluation criteria. The No Action and Institutional Controls alternatives are not recommended because they would not be protective of human health and the environment and would, therefore, not meet the threshold criteria. These two alternatives do not remove a probable source for groundwater contamination. In addition, natural attenuation processes in the Institutional Controls alternative are not effective for high concentrations of explosives in soils. The remaining three alternatives meet the threshold criteria for final remedial actions. The U.S. Army selected Bioremediation as the recommended alternative for SRU1 for the following reasons.

Bioremediation is recommended over Incineration because it is less expensive and Incineration may face difficulty in gaining public acceptance. Incineration may also require granting a waiver because of existing air regulations. Although more expensive than Excavation and Disposal, Bioremediation is recommended because it will treat the soils at JOAAP that pose the majority of the risk to human health and the environment. This will also satisfy the regulatory preference of CERCLA for treatment over disposal.

8.2.2 SRU2: Metals M Soil
The alternatives evaluated for this SRU are:

Alternative 1: No Action
Alternative 2: Institutional Controls
Alternative 3: Stabilization/Solidification
Alternative 4: Excavation and Disposal

SRU2 includes both interim and final remedial actions. Following is a summary of the comparative analysis of these alternatives.

Overall Protection to the Human Health and the Environment
Alternative 1 would not protect human health and the environment becauseno action would be taken to eliminate, reduce or control exposure pathways. Therefore, Alternative 1 does not meet this criterion.

Alternative 2 would provide some protection from contaminated soil by implementing restrictions such as fencing around contaminated areas and deed restrictions on excavation within these contaminated areas. Although these restrictions reduce access and potential exposure to contaminated areas, they do not remove contaminated soil or reduce its environmental effects. In addition, natural attenuation processes in the Institutional Controls alternative are generally not effective for removing metals from soils.

Table 8-1: Evaluation of Remedial Alternatives for SRU1 (Explosives in Soil)

		Evaluation Criteria								
		Threshold		*Balancing*					*Modifying*	
Remedial Alternative	Selected Alternative	1. Overall Protection of Human Health and the Environment **	2. Compliance with ARARs	3. Long-Term Effectiveness and Permanence	4. Reduction in Toxicity, Mobility or Volume Through Treatment	5. Short Term Effectiveness	6. Implementability	7. Cost (Net Present Worth in $1,000)	8. State Acceptance	9. Community Acceptance
1. No Action		○	○	◒	○	○	●	0	○	NA
2. Institutional Controls		○	○	◒	○	◒	●	3,000	◒	NA
3. Bioremediation	✔	●	●	●	●	◒	●	39,300	●	◒
4. On-site Incineration		●	●	●	●	◒	◒	76,600	●	NA
5. Excavation and Disposal		●	●	●	◒	◒	●	23,100	●	◒

Ranking Key: ● Fully meets criteria ◒ Partially meets criteria ○ Does not meet criteria

Notes: *NA – Not addressed by public comments*

** – *Threshold criterion 1 is applied fully for final remedial actions. It is applied to interim remedial actions while recognizing that the interim actions taken may not be the final actions.*

The remaining alternatives are considered to be protective to human health and the environment for final remedial actions because they eliminate the source be removing the contaminated soil to meet RGs. The remedial actions reduce the short- and long-term risk to ecological populations by reducing their exposure and uptake of contamination via soil and food. Alternative 3 removes the contaminated soil and treats the soils by immobilizing the metals prior to disposal in a permitted facility. Alternative 4 provides overall protection to human health and the environment by removing the soil and disposing it in a landfill. However, the contaminated soil is not subject to any treatment.

Compliance with Applicable or Relevant and Appropriate Requirements

Alternatives 1 and 2 will not comply with the ARARs. Alternatives 1 and 2 do not alleviate the localized impacts to the environment. Alternative 2 will not protective of the environment in localized areas where ecological impacts have been documented. Alternatve 2 will also result in disposal of solid and special waste. Alternative 2 and 4 will comply with the ARARs. These acceptable alternatives will either remove and treat soil (Stabilization/Solidification) prior to landfill disposal, or simply remove the contaminates soil and dispose of it in a permitted landfill (Excavation and Disposal)

Long-term Effectiveness and Permanence

Alternative 1 does not meet this criterion. Based on the existing metals concentrations and the proposed land use, this alternative does not adequately reduce the long-term risk to human health. Alternative 2 partially meets this criterion. This alternative will probably not decrease the risk to human health and the environment via natural attenuation, and the continued presence and migration of the contaminants may pose future risk to the environment. However, deed restrictions and the risk management strategies under Alternative 2 will reduce the potential for human exposure.

For final remedial actions, Alternatives 3 and 4 provide permanent solutions by excavating the contaminated media to meet final RGs and sending it for treatment or disposal. Neither alternative will be effective if the landfill fails. However, the landfill will be in compliance with RCRA and is designed to minimize the possibility of failure.

Residual risks associated with interim actions will be addressed with implementation of final remedial action.

Reduction of Toxicity, Mobility, of Volume through Treatment

Alternatives 1 and 2 would not provide any active reduction of toxicity, mobility, or volume of the contaminants because removal or treatment of the contaminated soil would not be components of these two alternatives. Alternatives 3 and 4 partially meet this criterion. Alternative 3 will immobilize but not alter the concentrations of metals, thereby reducing only their mobility. Alternative 4 reduces the mobility of the contaminants by removing the contaminated media from the site and containing them into a landfill. Alternative 4 will produce less material needed to be placed in the landfill than Alternative 3. However, Alternative 3 minimizes the potential for contaminant mobility if the landfill were to fail.

Short-term Effectiveness

Since no remedial actions are implemented under Alternative 1, this alternative poses no short-term impacts to the community, workers, or the environment. However, RGs will not be reached under this alternative. Alternative 1 does not meet this criterion. Minimal site activities are performed under Alternative 2, thus limiting the potential short term impacts to workers. However, the rate of natural attenuation is likely to be slow and will require a long time to achieve RGs. Therefore, this alternative partially meets this criterion.

Since Alternative 3 activities are conducted on-site, the community will not be subjected to any short-term impacts due to the remedial actions. However, there is a potential for workers exposure and a potential short-term impact to the environment as a result of erosion during excavation activities. Alternatives 3 and 4 may affect the community and the environment due the transportation of contaminated soil and the possibility of landfill failure.

Implementability

Alternatives 1 and 2 would be the most easily implemented. Alternative 1 would require no technical action, and Alternative 2 would require minimal action. Implementation of Alternatives 3 and 4 would mainly consist of excavation, treatment, and disposal. Technically, no significant constraints are anticipated for implementing either of these two alternatives. Administratively, there may be a potential long duration in meeting the necessary procedural requirements to implement both of these alternatives if the future proposed WCLF could not be built in time due to permitting delays. However, an existing permitted landfill could also be used to dispose of these wastes.

Alternative 4 provides an added benefit in that the soils could be determined suitable to be used as subgrade material for the proposed on-site landfill caps in SRU6. This option would provide an innovative and beneficial reuse of these soils that would not increase the project costs, would be protective to human health and the environment, and would not use up available space in the future proposed WCLF.

Cost

The following estimated cost includes capital, operation, and maintenance for all alternatives. These are present worth costs and are adjusted for the length of time to complete each alternative.

Alternative 1:	No Action	$	0
Alternative 2:	Institutional Controls	$	300,000
Alternative 3:	Stabilization/Solidification	$	6,700,000
Alternative 4:	Excavation and Disposal	$	4,000,000

State Acceptance

The State of Illinois concurs with the acceptability of Alternatives 3 and 4 based on these alternatives complying with the ARARs. The IEPA prefers Alternative 4: Excavation and Disposal.

Community Acceptance

Comments received during the Public review period and from the January 8, 1998, Public Meeting were transcribed and are included in the Responsiveness Summary of this document. Responses to these comments are also included in the Responsiveness Summary. Generally, these comments were positive in nature. There is a concern and request from the community to expedite the remediation process. The community appears to concur with the selected remedy.

8.2.2.1 Summary Evaluation of.Allernatives for SRU2

Table 8-2 compares the alternatives considered for SRU2 with respect to the nine CERCLA evaluation criteria. The No Action and Institutional Controls alternatives are not recommended because they would not be protective to human health and the environment and they do not meet the threshold criteria. In addition, natural attenuation processes in the Institutional Controls alternative are not effective for high concentrations of metals in soils. Both Solidification/Stabilization and Excavation and Disposal alternatives meet the threshold criteria for final remedial action sites. The U.S. Army selected Excavation and Disposal as the recommended alternative for the following reasons:

- Illinois currently requires that solidified/stabilized materials must still be disposed in a landfill to prevent exposure to the contaminants that, while bound in the treated material, are still present. Therefore, even if Solidfication/Stabilization was selected, the materials would still need to be disposed in a landfill. In addition, the Solidification/Stabilization process typically increases the volume of material that will need to be disposed. Excavation and Disposal will be less costly and, when compared to the Solidification/Stabilization, will reduce the volumeof material needed to be placed in the landfill.

- The Excavation and Disposal alternative provides an added benefit because the soils may be suitable for use as subgrade material for the proposed landfill caps in SRU6. This option would provide an innovative and beneficial reuse of these soils that would not increase the project costs, would be protective to human health and the environment, and would not use up available space in the future proposed WCLF. Finally, the Excavation and Disposal alternative is relatively easier and faster to implement.

Table 8-2: Evaluation of Remedial Alternatives for SRU2 (Metals in Soil)

Remedial Alternative	Selected Alternative	*Threshold*: 1. Overall Protection of Human Health and the Environment **	*Threshold*: 2. Compliance with ARARs	*Balancing*: 3. Long-Term Effectiveness and Permanence	*Balancing*: 4. Reduction in Toxicity, Mobility or Volume Through Treatment	*Balancing*: 5. Short Term Effectiveness	*Balancing*: 6. Implementability	*Balancing*: 7. Cost (Net Present Worth in $1,000)	*Modifying*: 8. State Acceptance	*Modifying*: 9. Community Acceptance
1. No Action		○	○	○	○	○	●	0	○	NA
2. Institutional Controls		●	○	◒	○	◒	●	300	○	NA
3. Stabilization/ Solidification		●	●	●	◒	●	●	6,700	●	NA
4. Excavation and Disposal	✔	●	●	●	◒	●	●	4,000	●	●

Ranking Key: ● Fully meets criteria ◒ Partially meets criteria ○ Does not meet criteria

Notes: NA – *Not addressed by public comments*

** – *Threshold criterion 1 is applied fully for final remedial actions. It is applied to interim remedial actions while recognizing that the interim actions taken may not be the final actions.*

8.2: SRU3: Explosives and Metals in Soil

The alternatives evaluated for this SRU are:

- Alternative 1: No Action
- Alternative 2: Institutional Controls
- Alternative 3: Bioremediation and Disposal
- Alternative 4: On-site Incineration
- Alternative 5: Excavation and Disposal

SRU3 includes both interim and final remedial actions. Following is a summary of the compartive analysis of these alternatives.

Overall Protection to the Human Health and the Environment

Alternative 1 would not protect human health and the environment because no action would be taken to eliminate, reduce or control exposure pathways. Therefore, Alternative 1 does not meet this criterion.

Alternative 2 would provide some protection from contaminated soil by implementing institutional controls such as fencing around contaminated areas and deed restrictions on excavation within these contaminated areas. Although these restictions reduce access and potential exposure to contaminated areas, they neither remove contaminated soil nor mitigate the potential for contaminant migration. In addition, natural attenuation processed in the Institutional Controls alternative are not effective for high concentrations of explosives and metals in soils. For these reasons, Alternative 2 does not meet this criterion.

The remaining alternatives are considered to be protective to human health and the environment because they eliminate or reduce the source by removing contaminated soil. The remedial actions reduce the short- and long-term risks to ecological populations by reducing their exposure and uptake of contamination via soil and food. Alternatives 3,4 and 5 provide overall protection to human health and the environment for final remedial actions by removing contaminated soil to meet RGs. In addition, these alternatives eliminate or reduce the potential for contaminant migration. The risks are reduced by treatment for Alternatives 3 and 4. The risks are reduced by engineering controls (disposal in a landfill) for Alternative 5.

Compliance with Applicable or Relevant and Appropriate Requirements

With the exception of Alternatives 1 and 2, all the alternatives will comply with the ARARs. Alternatives 1 and 2 do not alleviate the localized impacts to the environment. Alternatives 3, 4, and 5 will adequately protect human health and the environment and will also comply with ARARs based on appropriate designs and implementation.

Long-term Effectiveness and Permanence

Based on the existing explosives and metals concentrations and the proposed land use, Alternative 1 does not reduce the long-term risk to human health. In addition, the potential for contaminant migration may pose a future risk to the environment. Therefore, Alternative 1 does not meet this criterion.

Alternative 2 partially meets this criterion. This alternative will slightly decrease the risk to human health and the environment via natural attenuation. Deed restrictions and the risk management strategies under this alternative will also reduce the potential for human exposure. However, the continued presence and migration of the contaminants may pose future risk to the environment.

For final remedial actions, Alternatives 3, 4, and 5 eliminate the potential for future risks associated with direct contact and contaminants migration by excavating contaminated media to meet RGs. Alternative 5 would not be effective if the landfill fails. However, the landfill will be in compliance with RCRA and is designed to minimize the possibility of failure.

Residual risks associated with interim actions will be addressed with implementation of final remedial action.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternatives 1 and 2 would not provide any active reduction of toxicity, mobility, or volume of the contaminants because removal or treatment of the contaminated soil would not be components of these two alternatives.

Alternatives 3 and 4 permanently reduce the toxicity, mobility, and volumes of explosives by removing and treating them; however, Alternatives 3 and 4 reduce only the mobility and volumes of the metals. These two alternatives fully meet this criterion.

Alternative 5 partially meets this criterion. This alternative reduces the mobility of the contaminants by removing the contaminated media from the site and containing them into a landfill. However, this alternative does not satisfy the statutory preference for treatment.

Short-term Effectiveness
Since no remedial actions are implemented under Alternative 1, this alternative poses no short-term impacts to the community, workers, or the environment. However, RGs will not be reached under this alternative. Alternative 1 does not meet this criterion. Minimal site activities are performed under Alternative 2, limiting short-term impacts to workers. However, the rate of natural attenuation is likely to be slow and will require a long time to achieve RGs. Therefore, this alternative partially meets this criterion.

Alternatives 3 and 5 fully meet this criterion while Alternative 4 partially meets it. There is a potential for workers' exposure and a potential short-term impact to the environment as a result of erosion during excavation activities for these three alternatives. Alternatives 3, 4, and 5 may have short-term impacts on the community, worker health, and the environment due the transportation of contaminated soil and the possibility of landfill failure. Alternative 4 poses potential short-term impacts from the physical hazards associated with operating the incinerator and pollutant transport in case of air pollution control equipment failure.

Implementability
Alternatives 1 and 2 would be the most easily implemented. Alternative 1 would require no technical action, and Alternative 2 would require minimal action. Implementation of Alternatives 3 and 4 would mainly consist of excavation, treatment, and disposal. However, Alternative 5 would not require treatment and is easily implemented. Technically, Alternatives 3 and 4 may not effectively reduce metals concentrations, thus still requiring disposal of the treated materials in a permitted facility. Administratively, there may be a potential long duration in meeting the necessary procedural requirements to implement Alternative 4 (On-site Incineration). In addition, Alternative 4 implementation may involve extensive public hearings and may face difficulty in gaining public acceptance.

Cost
The following estimated cost includes capital, operational, and maintenance for all allernatives. These are present worth costs and are adjusted for the length of time to complete each alternative.

Alternative 1:	No Action	$	0
Alternative 2:	Institutional Controls	$	3000,000
Alternative 3:	Bioremediation and Disposal	$	4,000,000
Alternative 4:	On-Site Incineration	$	15,800,000
Alternative 5:	Excavation and Disposal	$	2,800,000

It should be noted that the cost estimate for Alternative 3 assumes the most expensive of the currently available treatment options.

State Acceptance
The State of Illinois concurs with the acceptability of Alternatives 3, 4, and 5 based on these alternatives complying with the ARARs. The IEPA prefers a combination of Alternatives 3 and 5.

Community Acceptance
Comments received during the Public review period and from the January 8, 1998, Public Meeting were transcribed and are included in the Responsiveness Summary of this document. Responses to these comments are also included in the Responsiveness Summary. Generally, these comments were positive in nature. There is a concern and request from the community to expedite the remediation process. In general, the community has a preference for treating the contamination and appears to concur with the selected remedy.

8.2.3.1 Summary Evaluation of Alternatives for SRU3

Table 8-3 compares the alternatives considered for SRU3 with respect to the nine CERCLA evaluation criteria. The No Action and Institutional Controls alternatives are not recommended because they would not be protective of human health and the environment and they would not meet the threshold criteria. In addition, natural attenuation processes in the Institutional Controls alternative are not effective for high concentrations of explosives and metals in soils. The remaining three alternatives meet the threshold criteria for final remedial actions. The U.S. Army selected both Excavation and Disposal and Bioremediation and Disposal as the recommended alternatives for the following reasons.

Two alternatives were selected for this SRU because sites M5 and M6 might contain soil that exhibits hazardous characteristics (i.e., explosives concentration > 100,000 ppm) or contains RCRA listed wastes, and, therefore, these soils will require treatment for explosives prior to disposal in a landfill. Since soils from both of these alternatives will be disposed in a landfill, just excavating and disposing non-hazardous soil will be less costly and will reduce the volume of material needed to be placed in the landfill. The selection of these two alternatives was recommended over Incineration because this approach is less expensive and Incineration may face difficulty in gaining public acceptance. Incineration may also require granting of a waiver because of existing air regulations.

Table 8-3: Evaluation of Remedial Alternatives for SRU3 (Explosives and Metals in Soil)

		Evaluation Criteria								
		Threshold		*Balancing*					*Modifying*	
Remedial Alternative	Selected Alternative	1. Overall Protection of Human Health and the Environment **	2. Compliance with ARARs	3. Long-Term Effectiveness and Permanence	4. Reduction in Toxicity, Mobility or Volume Through Treatment	5. Short Term Effectiveness	6. Implementability	7. Cost (Net Present Worth in $1,000)	8. State Acceptance	9. Community Acceptance
1. No Action		○	○	○	○	○	●	0	○	NA
2. Institutional Controls		○	○	◒	○	◒	●	300	○	NA
3. Bioremediation and Disposal	✔	●	●	●	●	●	●	4,000	●	◒
4. On-site Incineration		●	●	●	●	◒	◒	15,800	●	NA
5. Excavation and Disposal	✔	●	●	●	◒	●	●	2,800	●	◒
Total for Alternatives 3,5(1)								6,800		

Ranking Key: ● Fully meets criteria ◒ Partially meets criteria ○ Does not meet criteria

Notes: *NA – Not addressed by public comments*

** – *Threshold criterion 1 is applied fully for final remedial actions. It is applied to interim remedial actions while recognizing that the interim actions taken may not be the final actions.*

(1) Selection of Bioremediation (Alternative 3) will be based on the explosive contamination in the soil. Costs for Alternative 3 and 5 are based on estimated volumes going to each disposal alternative.

8.2.4 SRU4: PCBs in Soil

The alternatives evaluated for this SRU are:

Alternative 1:	No Action
Alternative 2:	Institutional Controls
Alternative 3:	Chemical Dehalogenation
Alternative 4:	On-site Low-temperature Thermal Desorption (LTTD
Alternative 5:	Excavation/Incineration and Disposal

SRU4 includes only final remedial actions. Following is a summary of the comparative analysis of these alternatives.

Overall Protection to the Human Health and the Environment

Alternative 1 would not protect human health and the environment because no action would be taken to eliminate, reduce or control exposure pathways. Therefore, Alternative 1 does not meet this criterion. Alternative 2 would provide some protection from contaminated soil by implementing restrictions such as fencing around contaminated areas and deed restrictionson excavation within these contaminated areas. Although these restrictions reduce access and potential human exposure to contaminated areas, they do not eliminate potential environmental impacts. In addition, natural attenuation processes in the Institutional Controls alternative are not effective for high concentrations of PCBs in soils.

The remaining alternatives are considered to be protective to human health and the environment. Alternatives 3 and 4 remove and treat the contaminated soils to levels below the RGs. Human health risk and the potential for contaminant migration is eliminated through the excavation and treatment of contaminated soil. Alternative 5 provides overall protection to human health and the environment by removing the soil and disposing it in a permitted landfill. However, the contaminated soil is not subjected to any treatment if PCB concentrations are below 500 ppm. Some limited potential for future impacts to human health and the environment exist with this alternative in the event of a failure in the landfill containment control.

Compliance with Applicable or Relevant and Appropriate Requirements

Alternatives 1 and 2 will not comply with the ARARs. While Alternative 2 does reduce the exposure pathways, it, as well as Alternative 1, may not be protective of the environment because PCBs may potentially bioaccumulate in some ecological receptors. Alternatives 3, 4, and 5 will comply with the ARARs. These acceptable alternatives will either remove and treat soil or remove contaminated soil to an alternate controlled location. Alternatives 3 and 4 will require the USEPA Regional Administrator approval to treat soils with concentrations above 500 ppm. Alternatives 3, 4, and 5 will adequately protect human health and the environment.

Long-term Effectiveness and Permanence

Based on the existing PCB concentrations and the proposed land use, Alternative 1 does not reduce the long-term risk to human health. In addition, the potential for contaminant migration may pose a future risk to the environment. Therefore, Alternative I does not meet this criterion. Alternative 2 partially meets this criterion. This alternative will slightly decrease the risk to human health and the environment via natural attenuation, although natural attenuation does not effectively reduce PCB concentration. Deed restrictions and the risk management strategies under this alternative will also reduce the potential for human exposure. However, the continued presence and migration of the contaminants may pose future risk to the environment.

Alternatives 3, 4, and 5 eliminate the potential for future risks associated with direct contact and contaminants migration by excavating the contaminated media to levels below the RGs and sending it for treatment or disposal.

Reduction of Toxicity, Mobility, or Volume through Treatment
Alternatives 1 and 2 would not provide any active reduction of toxicity, mobility, or volume of the contaminants because removal or treatment of the contaminated soil would not be components of these two alternatives. Alternatives 3, 4 and 5 permanently reduce the toxicity, mobility, and volumes of contaminants by removing and treating or disposing them. Therefore, these three alternatives meet this criterion.

Short-term Effectiveness
Since no remedial actions are implemented under Alternative 1, this alternative poses no short-term impacts to the community, workers, or the environment. However, RGs will not be reached under this alternative. Alternative 1 does not meet this criterion. Minimal site activities are performed under Alternative 2, limiting short-term impacts to workers. However, the rate of natural attenuation is likely to be slow and will require a long time to achieve RGs, T'herefore, this alternative partially meets this criterion.

Alternatives 3 and 4 partially meet this criterion while Alternative 5 fully meets it. Since Alternatives 3 and 4 activities are conducted on-site, the community will not be subjected to any short-term impacts due to the remedial actions. However, there is a potential for workers' exposure. Alternative 3 and 4 could have short-term impacts on the environment as a result of erosion during excavation activities. Alternative 5 may have short-term impacts on the community, worker health, and the environment due the transportation of contaminated soil for off-site disposal.

Implementability
Alternatives 1 and 2 would be readily implemented. Alternative 1 would require no technical action, and Alternative 2 would require minimal action. Alternatives 3 and 5 would mainly consist of excavation, treatment or disposal. These two alternatives fully meet this criterion. Alternative 4 would partially meet this criterion. Technically, there may be some constraints for implementing Alternatives 3 and 4. Alternatives 3 and 4 would need treatability studies and USEPA Regional Administrator approval to treat soils with concentrations above 500 ppm.

Cost
The following estimated cost includes capital, operational, and maintenance for all alternatives. These are present worth costs and are adjusted for the length of time to complete each alternative.

Alternative 1:	No Action	$	0
Alternative 2:	Institutional Controls	$	8,000
Alternative 3:	Chemical Dehalogenation	$	4,100,000
Alternative 4:	On-site LTTD	$	2,400,000
Alternative 5:	Excavation/Incineration and Disposal	$	1,400,000

State Acceptance
The State of Illinois concurs with the acceptability of Alternatives 3, 4 and 5 based on these alternatives complying with the ARARs. The IEPA prefers Alternative 5: Excavation/Incineration and Disposal.

Community Acceptance
Comments received during the Public review period and from the January 8, 1998, Public Meeting were transcribed and are included in the Responsiveness Summary of this document. Responses to these comments are also included in the Responsiveness Summary. Generally, these comments were positive in nature. There is a concern and request from the community to expedite the remediation process. In

general, the community has a preference for treating the contamination and appears to concur with the selected remedy.

8.2.4.1 Summary Evaluation of Alternatives for SRU4

Table 8-4 compares the alternatives considered for SRU4 with respect to the nine CERCLA evaluation criteria. The threshold criteria could not be met by the No Action and Institutional Controls alternatives; hence these two alternatives were not selected. In addition, natural attenuation processes in the Institutional Controls alternative are not effective for high concentrations of PCB in soils. The U.S. Army selected Excavation and Disposal as the recommended alternative for SRU4 for the following reasons.

The threshold criteria could be met by the recommended alternative, by Chemical Dehalogenation and by On-site Low-temperature Thermal Desorption. Each would reduce the risk of direct contact with the PCBs in the soil and debris. However, the implementability, short-term effectiveness, and cost of Excavation and Disposal made it more attractive than other two alternatives.

Table 8-4: Evaluation of Remedial Alternatives for SRU4 (PCBs in Soil)

		Evaluation Criteria								
		Threshold		*Balancing*					*Modifying*	
Remedial Alternative	Selected Alternative	1. Overall Protection of Human Health and the Environment **	2. Compliance with ARARs	3. Long-Term Effectiveness and Permanence	4. Reduction in Toxicity, Mobility or Volume Through Treatment	5. Short Term Effectiveness	6. Implementability	7. Cost (Net Present Worth in $1,000)	8. State Acceptance	9. Community Acceptance
1. No Action		○	○	○	○	○	●	0	○	NA
2. Institutional Controls		●	○	◒	○	◒	●	800	○	NA
3. Chemical Dehalogenation		●	●	●	●	◒	●	4,100	◒	NA
4. On-site Low-temperature Thermal Desorption		●	●	●	●	◒	◒	2,400	◒	NA
5. Excavation/ Incineration and Disposal	✔	●	●	●	●	●	●	1,400	●	●

Ranking Key: ● Fully meets criteria ◒ Partially meets criteria ○ Does not meet criteria

Notes: NA ..- Not addressed by public comments

*** - All remedial actions are final for SRU4. Threshold criterion 1 is applied fully to these actions.*

8.2.5 SRU5: Organics in Soil

The alternatives evaluated for this SRU are:

Alternative 1:	No Action
Alternative 2:	Institutional Controls
Alternative 3:	Bioremediation
Alternative 4:	Solvent Extraction
Alternative 5:	On-site Low-temperature Thermal Desorption (LTTD)
Alternative 6:	Excavation and Disposal

SRU5 includes only interim remedial actions. Following is a summary of the comparative analysis of these alternatives.

Overall Protection to the Human Health and the Environment

Alternative 1 would not protect human health and the environment because no action would be taken to eliminate, reduce or control exposure pathways. Therefore, Alternative 1 does not meet this criterion. Alternative 2 is considered protective to human health and the environment. This alternative would provide protection of human health by implementing restrictions such as fencing around contaminated areas and deed restrictions on excavation within these contaminated areas. Natural attenuation processes can reduce the concentrations of organics in the soil, but risks to the environment may exist while these processes occur.

The remaining alternatives are considered to be protective to human health and the environment because they eliminate or reduce the source by removing contaminated soil. The remedial actions reduce the short- and long-term risks to ecological populations by reducing their exposure and uptake of contamination via soil and food. Human health risk and the potential for contaminant migration is eliminated or reduced through the excavation of contaminated soil. The risks are reduced by treatment for Alternatives 3, 4 and 5. The risks are reduced by engineering controls for Alternative 6.

Compliance with Applicable or Relevant and Appropriate Requirements

Alternative 1 will not comply with the ARARs, In Alternative 1 exposure pathways are still present and there still exists a potential for contaminant migration.

Alternatives 2, 3, 4, 5 and 6 will comply with the ARARs. These alternatives will restrict property access, remove and treat soil, or remove contaminated soil to an alternate controlled location. Alternatives 2, 3, 4, 5 and 6 will adequately protect human health and the environment.

Long-term Effectiveness and Permanence

Based on existing organic concentrations and proposed land use, Alternative 1 does not reduce the long-term risk to human health. Although no measurable negative on the environment has been identified to date, the potential for contaminant migration may pose a future risk to the environment. Therefore, Alternative 1 does not meet this criterion.

Alternative 2 partially meets this criterion, This alternative will slowly decrease the risk to human health and the environment via natural attenuation. Deed restrictions and the risk management strategies under this alternative will also reduce the potential for human exposure. However, the continued presence and migration of the contaminants may pose risks to the environment until concentrations are lowered via natural attenuation processes.

Alternatives 3, 4 and 5 provide the most permanent solution since contaminants are treated to meet RGs. It should be noted that Alternative 6 would not be effective if the disposal landfill fails, However, the landfill will be in compliance with RCRA and is designed to minimize the possibility of failure.

Residual risks associated with interim actions will be addressed with implementation of final remedial action.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternatives 1 and 2 do not provide any active reduction of toxicity, mobility, or volume of the contaminants because removal or treatment of the contaminated soil would not be components of these alternatives.

Alternatives 3, 4 and 5 permanently reduce the toxicity, mobility, and volumes of' contaminants by removing and treating them. Therefore, these three alternatives fully meet this criterion. Alternative 6 partially meets this criterion. This alternative removes the contaminated soil from the sites and transports it to a landfill without any treatment. Therefore, the overall toxicity and volume will not be affected by this alternative, but mobility will be reduced.

Short-term Effectiveness

Since no remedial actions are implemented under Alternative 1, this alternative poses no short-term impacts to the community, workers, or the environment. However, RGs will not be reached under this alternative. Alternative 1 does not meet this criterion. Minimal site activities are performed under Alternative 2, limiting short-term impacts to workers. However, the rate of natural attenuation is likely to be slow and will require a long time to achieve RGs. Therefore, this alternative partially meets this criterion.

Alternatives 3, 4, 5, and 6 fully meet this criterion. Alternatives 3, 4, and 5 activities are conducted onsite, therefore the community will not be subjected to any short-term impacts due to the remedial actions. However, for these three alternatives, there is a potential for workers' exposure and short-term impacts to the environment as a result of erosion during excavation activities. Alternative 6 may have short-term impacts on the community, worker health, and the environment due the transportation of contaminated soil for off-site disposal.

Implementability

Alternatives 1 and 2 would be the most easily implemented. Alternative 1 would require no technical action, and Alternative 2 would require minimal action. Implementation of Alternatives 3 and 6 would mainly consist of excavation, treatment or disposal. These two alternatives fully meet this criterion. Alternatives 4 and 5 partially meet this criterion. Technically, there may be some constraints for implementing Alternatives 4 and 5, but no constraints are anticipated for Alternatives 3 and 6.

Cost

The following estimated cost includes capital, operational, and maintenance for all alternatives. These are present worth costs and are adjusted for the length of time to complete each alternative.

Alternative 1:	No Action	$ 0
Alternative 2:	Institutional Controls	$ 100,000
Alternative 3:	Bioremediation	$ 2,200,000
Alternative 4:	Solvent Extraction	$ 1,300,000
Alternative 5:	On-site LTTD	$ 1,800,000
Alternative 6:	Excavation and Disposal	$ 300,000

State Acceptance
The State of Illinois concurs with the acceptability of Alternatives 3, 4 and 6 basedon these alternatives complying with the ARARs. The 1EPA prefers Alternative 6: Excavation and Disposal.

Community Acceptance
Comments received during the Public review period and from the January 8, 1998, Public Meeting were transcribed and are included in the Responsiveness Summary of this document. Responses to these comments are also included in the Responsiveness Summary. Generally, these comments were positive in nature. There is a concern and request from the community to expedite the remediation process. The community appears to concur with the selected remedy.

8.2.5.1 Summary Evaluation of Alternatives for SRU5
Table 8-5 compares the alternatives considered for SRU5 with respect to the nine CERCLA evaluation criteria. The threshold criteria could not be met by the No Action alternative, hence this alternative was not selected. The Institutional Controls alternative was not selected because although this alternative met the threshold criteria, its long- and short-term effectiveness, and its reduction in toxicity, mobility or volume through treatment were only partially met. Natural attenuation processes in the Institutional Controls alternative are not effective for high organics concentrations in the soils. The U.S. Army selected Excavation and Disposal as the recommended alternative for SRU 5 for the following reasons.

The threshold criteria could be met by this alternative as well as by Bioremediation, Solvent Extraction, and On-site Low-temperature Thermal Desorption. Each would reduce the risk of direct contact with the organic compounds in the soil and debris. However, because Excavation and Disposal is easier to implement, can be implemented in a quicker time frame, and has a lower cost, it was selected as the recommended alternative.

8,2.6 SRU6: Landfills
The alternatives evaluated for this SRU are:

Alternative 1: No Action
Alternative 2: Institutional Controls
Alternative 3: Capping
Alternative 4: Excavation and Disposal

SRU6 includes only final remedial actions. Following is asummary of the comparative analysis of these alternatives.

Overall Protection to the Human Health and the Environment
Alternatives 1 and 2 do not meet this criterion. These two alternatives do not adequately provide protection to human health. Alternative 1 does not eliminate the potential for direct human contact with contaminants and potential hazards at the sites. Alternative 2 minimizes human health risks by preventing direct contact, but it does not eliminate the potential for contaminants migration.

Alternative 3 fully meets this criterion. Ibis alternative is protective of human health and the environment through containment of the waste and elimination of exposure routes, Alternative 4 fully meets this criterion. This alternative provides immediate and permanent protection to human health and the environment by removing the contaminated soil to a permitted landfill. Some minimal potential for future impacts to human health and the environment exist in this option in the event of a failure of the landfill containment structure.

Table 8-5: Evaluation of Remedial Alternatives for SRU5 (Organics in Soil)

Remedial Alternative	Selected Alternative	Evaluation Criteria: Threshold — 1. Overall Protection of Human Health and the Environment **	2. Compliance with ARARs	Balancing — 3. Long-Term Effectiveness and Permanence	4. Reduction in Toxicity, Mobility or Volume Through Treatment	5. Short Term Effectiveness	6. Implementability	7. Cost (Net Present Worth in $1,000)	Modifying — 8. State Acceptance	9. Community Acceptance
1. No Action		○	○	○	○	○	●	0	○	NA
2. Institutional Controls		●	●	◒	○	◒	●	100	◒	NA
3. Bioremediation		●	●	●	●	●	●	2,200	●	NA
4. Solvent Extraction		●	●	●	●	●	◒	1,300	●	NA
5. On-site Low-Temperature Thermal Desorption		●	●	●	●	●	◒	1,800	◒	NA
6. Excavation and Disposal	✔	●	●	●	◒	●	●	300	●	●

Ranking Key: ● Fully meets criteria ◒ Partially meets criteria ○ Does not meet criteria

Notes: *NA – Not addressed by public comments*

** – *Threshold criterion 1 is applied fully for final remedial actions. It is applied to interim remedial actions while recognizing that the interim actions taken may not be the final actions.*

compliance with Applicable or Relevant and Appropriate Requirements

Alternatives 1 and 2 will not comply with ARARs. InAlternative 1, exposure pathways are still present and there still exists a potential for contaminant migration. In alternative 2, the potential for contaminants migration will still be present. In addition, neither of these alternatives comply with Illinois State laws for landfill closure.

Alternative 3 and 4 will comply with the ARARs. Alternatives 3 and 4 will adequately protect human health and the environment.

Long-term Effectiveness and Permanence

Alternative 1 does not meet this criterion. Based on the existing contamination and the proposed land use, Alternative 1 does not reduce the long-term risk to human health. In addition, the potential for contaminant migration may pose future risks to the environment. Alternative 2 partially meets this criterion. This alternative will slightly decrease the risk to human health by reducing the potentialfor human exposure. However, the continued presence and migration of the contaminants may pose future risk to the environment.

Alternative 3 fully meets this criterion. In Alternative 3, there is residual risk with the contaminants and other hazards remaining on-site and contained by the caps. The caps reduce the human health risk and environmental risk to acceptable levels. In addition the caps will prevent infiltration of precipitation that may leach out contaminants from the landfills. Alternative 4 also fully meets this criterion. This alternative excavates the contaminated media and eliminates the potential for future risks associated with direct contact and contaminants migration by placing the wastes in a permitted landfill.

Reduction of Toxicity, Mobility, or Volume through Treatment
Alternatives 1 and 2 would not provide any active reduction of toxicity, mobility, or volume of the contaminants because removal or treatment of the contaminated soil would not be components of this alternative.

Alternatives 3 and 4 partially meet this criterion. Alternative 3 reduces the mobility of contaminants, but not the overall toxicity and volume. Alternative 4 removes the contaminated soil from the sites and transports it to a landfill without any treatment. Therefore,the overall toxicity and volume of the wastes will not be affected by this alternative, but their mobility will be reduced.

Short-term Effectiveness
Since no remedial actions are implemented under Alternative 1, this alternative poses no short-terrn impacts to the community, workers, or the environment. However, RGs will not be reached under this alternative. Alternative 1 does not meet this criterion. Minimal site activities are performed under Alternative 2, limiting the short-term impacts on workers. However, wastes will still be present in these units. Therefore, this alternative partially meets this criterion.

Alternative 3 fully meets this criterion. Alternative 3 poses no short term impacts to the community because all remedial activities will be occurring on-site. Worker health may be affected during the excavation and regrading of the contaminated media. There is also a potential short-term impact to the environment due to the erosion during the remedial activities.

Alternative 4 fully meets this criterion. Most of the activities in this alternative are conducted on-site, therefore the community, worker health, and the environment will be subjected to short-term impacts due to the excavation and transportation of contaminated soil for off-site disposal.

Implementability
Alternatives 1 and 2 would be the most easily implemented. Alternative 1 would require no technical action, and Alternative 2 would require minimal action. Alternatives 3 would mainly consists of regrading. Alternative 4 would mainly consist of excavation and disposal. These two alternatives fully meet this criterion. There are no technical constraints for meeting this criterion.

cost
The following estimated cost includes capital, operational, and maintenance for all alternatives. These are present worth costs and are adjusted for the length of time to complete each alternative.

Alternative 1:	No Action	$ 0
Alternative 2:	Institutional Controls	$ 3,000,000
Alternative 3:	Capping	$19,900,000
Alternative 4:	Excavation and Disposal	$12,100,000

State Acceptance

The State of Illinois concurs with the acceptability of Alternatives 3 and 4 based on these alternatives complying with the ARARs. The IEPA prefers the combination of Alternative 3 and 4.

Community Acceptance

Comments received during the Public review period and from the January 8, 1998, public Meeting were transcribed and are included in the Responsiveness Summary of this document. Responses to these comments are also included in the Responsiveness Summary. Generally, these comments were positive in nature. There is a concern and request from the community to expedite the remediation process. The community appears to concur with the selected remedy.

8.2.6.1 Summary Evaluation of Alternatives for SRU6

Table 8-6 compares the alternatives considered for SRU6 with respect to the nine CERCLA evaluation criteria. The threshold criteria could not be met by the No Action and Institutional controls alternatives because they neither prevent human exposure to the waste nor reduce potential waste migration, therefore these two alternatives were not selected. Additionally, natural attenuation processes in the Institutional Controls alternative are not effective at treating materials buried in the landfills. The U.S. Army determined that Capping of the landfills in L3, M11 and M13; and Excavation and Disposal of soils in L4, M1 and M9 would best serve the cleanup requirements of the sites in SRU6.

The threshold criteria are met by this combination of actions. These recommended alternatives would be expensive; however, they would reduce the risks of direct contact with human and the environment. Because the potential presence of UXO poses workers safety issues, Capping rather than Excavation and Disposal is the recommended alternative for L3. Although the landfill in site L4 could be capped, the recommended alternative is Excavation and Disposal because this landfill is in a flood plain. The reasons why the sites in M1 and M9 are being excavated and disposed of are:

- Three previous attempts to cap these landfills failed,
- Disposal provides a more effective containment than Capping, and
- The ash at M1 may be in direct contact with groundwater and a continuing source of groundwater contamination.

The Army is seeking ways and means for beneficial reuse of the ash from sites M1 and M9.

8.2.7 SRU7: Sulfur

The alternatives evaluated for this SRU are:

Alternative 1:	No Action
Alternative 2:	Institutional Controls
Alternative 3:	Removal and Recycling or Disposal

The removal of sulfur is not regulated under CERCLA. SRU7 includes only final remedial actions. Following is a summary of the comparative analysis of these alternatives.

Overall Protection to the Human Health and the Environment

Alternatives 1 and 2 do not meet this criterion. Alternative 1 does not eliminate the potential for direct human contact with contaminants and potential hazards at the sites. Alternative 2 minimizes human health risks by preventing direct contact. Both of these alternatives do not provide any protection to the environment. Alternative 3 fully meets this criterion. This alternative provides immediate and permanent protection to human health and the environment by removing the sulfur.

Table 8-6: Evaluation of Remedial Alternatives for SRU6 (Landfills)

Remedial Alternative	Selected Alternative	Evaluation Criteria: Threshold		Balancing					Modifying	
		1. Overall Protection of Human Health and the Environment **	2. Compliance with ARARs	3. Long-Term Effectiveness and Permanence	4. Reduction in Toxicity, Mobility or Volume Through Treatment	5. Short Term Effectiveness	6. Implementability	7. Cost (Net Present Worth in $1,000)	8. State Acceptance	9. Community Acceptance
1. No Action		○	○	○	○	○	●	0	○	NA
2. Institutional Controls		○	○	◒	○	◒	●	3,000	○	NA
3. Capping (Sites L3, M11 and M13)[1]	✔	●	●	●	◒	●	●	19,900	●	◒
4. Excavation and Disposal (Sites L4, M1 and M9)[2]	✔	●	●	●	◒	●	●	12,100	●	◒

Ranking Key: ● Fully meets criteria ◒ Partially meets criteria ○ Does not meet criteria

Notes: NA - Not addressed by public comments

*** - All remedial actions are final for SRU6. Threshold criterion 1 is applied fully to these actions.*

1) Sites L3 and M13 proposed for Subtitle D cap. Site M11 proposed for Subtitle C cap.

2) Sites L4, M1, and M9 proposed for excavation and disposal in WCLF or other permitted solid waste landfill off-site.

Compliance with Applicable or Relevant and Appropriate Requirements

Alternative 1 will not comply with the ARARs. In Alternative 1 exposure pathways are still present and there will exists a potential for contaminant migration. Alternative 2 fully meets this criterion. The potential for contaminants migration will still be present; however human exposure will be eliminated. Alternative 3 will comply with the ARARs. Alternative 3 will adequately protect human health and the environment. In addition, this alternative included a possibility for the reuse or recycle of sulfur.

Long-term Effectiveness and Permanence

Alternate 1 does not meet this criterion. Based on the existing contamination and the proposed land use, Alternative 1 does not reduce the long-term risk to human health. In addition, the potential for contaminant migration may pose future risks to the environment.

Alternative 2 partially meets this criterion. This alternative will slightly decrease the risk to human health and will somewhat be effective at reducing the potential for human exposure. However, the continued presence and migration of the contaminants may pose future riskto the environment. Alternative 3 fully meets this criterion. This alternative excavates the contaminated media and eliminates the potential for future risks associated with direct contact and contaminants migration.

Reduction of Toxicity, Mobility, or Volume through Treatment
Alternatives 1 and 2 do not provide any active reduction of toxicity, mobility, or volume of the contaminants because removal or treatment of the contaminated soil would not be components of these alternatives.

Alternative 3 fully meets this criterion. Alternative 3 removes the sulfur from the sites and transports it to a landfill without any treatment or for reuse/recycle. Therefore, the overall toxicity, mobility, and volume will not be affected by this alternative if the ultimate disposal is in a landfill. However, there will be a great reduction in toxicity, mobility, and volume if the sulfur is reused or recycled.

Short-term Effectiveness
Since no remedial actions are implemented under Alternative 1, this alternative poses no short-term impacts to the community, workers, or the environment. However, RGs will not be reached under this alternative. Alternative 1 does not meet this criterion. Minimal site activities are performed under Alternative 2, limiting short-term impacts to workers. However, the rate of natural attenuation to achieve RGs is likely to be slow. Therefore, this alternative partially meets this criterion.

Alternative 3 fully meets this criterion. Most of the activities in this alternative are conducted on-site; therefore the community, worker health, and the environment will be subjected to minimal short-term impacts due to the excavation and the transportation of sulfur for off-site disposal.

Implementability
Alternatives 1 and 2 would be the most easily implemented. Alternative 1 would require no technical action, and Alternative 2 would require minimal action. Implementation of Alternatives 3 would mainly consist of excavation and disposal. Thisalternative fully meets this criterion. There are neither technical nor administrative constraints for meeting this criterion.

cost
The following estimated cost includes capital, operational, and maintenance for all alternatives. These are present worth costs and are adjusted for the length of time to complete each alternative.

Alternative 1:	No Action	$ 0
Alternative 2:	Institutional Controls	$ 100,000
Alternative 3:	Removal and Recycle or Disposal	$ 200,000

State Acceptance
The IEPA concurs with the acceptability of and prefers Alternative 3 based on this alternative complying with the ARARs.

Community Acceptance
Comments received during the Public review period and from the January 8, 1998, Public Meeting were transcribed and are included in the Responsiveness Summary of this document. Responses to these comments are also included in the Responsiveness Summary. Generally, these comments were positive in nature. There is a concern and request from the community to expedite the remediation process. The community appears to concur with the selected remedy.

8.2.7.1 Summary Evaluation of Alternatives for SRU7
Table 8-7 compares the alternatives considered for SRU7 with respect to the nine CERCLA evaluation criteria. The threshold criteria could not be met by the No Action and Institutional Controls alternatives

because they would not reduce the risks to the environment, therefore these two alternatives were not selected. Natural attenuation processes in the Institutional Controlsalternative may be determined not to be effective in reducing the amount of sulfur present. In addition, these two alternatives do not remove a probable source for groundwater contamination. The U.S. Army selected direct Removal and either Disposal or Recycling of the sulfur as the recommended alternative for SRU7.

This alternative may provide an innovative and beneficial reuse of the sulfur and would not increase project costs. In addition, this alternative would be protective to human health and the environment and would not use up space in the future proposed WCLF.

Table 8-7: Evaluation of Remedial Alternatives for SRU7 (Sulfur)

		Evaluation Criteria								
		Threshold		*Balancing*					*Modifying*	
Remedial Alternative	Selected Alternative	1. Overall Protection of Human Health and the Environment **	2. Compliance with ARARs	3. Long-Term Effectiveness and Permanence	4. Reduction in Toxicity, Mobility or Volume Through Treatment	5. Short Term Effectiveness	6. Implementability	7. Cost (Net Present Worth in $1,000)	8. State Acceptance	9. Community Acceptance
1. No Action		○	○	○	○	○	●	0	○	NA
2. Institutional Controls		○	●	◒	○	◒	●	100	○	NA
3. Removal/Recycle/ Disposal	✔	●	●	●	●	●	●	200	●	●

Ranking Key: ● Fully meets criteria ◒ Partially meets criteria ○ Does not meet criteria

Notes: NA - Not addressed by public comments

*** - All remedial actions are final for SRU6. Threshold criterion 1 is applied fully to these actions.*

8.2.8 Summary of Selected Remedies for all SRUs

Table 8-8 presents a summary evaluation of selected remedies for each SRU. The total estimated net present worth of remedial actions for the SOU is $84,000,000.

Table 8-8: Summary of Recommended Remedial Alternatives for All SRUs—LAP and MFG Areas

		Evaluation Criteria								
		Threshold		*Balancing*					*Modifying*	
Remedial Alternative	SRU	1. Overall Protection of Human Health and the Environment	2. Compliance with ARARs	3. Long-Term Effectiveness and Permanence	4. Reduction in Toxicity, Mobility or Volume Through Treatment	5. Short Term Effectiveness	6. Implementability	7. Cost (Net Present Worth in $1,000)	8. State Acceptance	9. Community Acceptance
Bioremediation	1	●	●	●	●	◒	●	39,300	●	◒
Excavation and Disposal	2	●	●	●	◒	●	●	4,000	●	●
Bioremediation and Disposal, and Excavation and Disposal	3	●	●	●	●	●	●	6,800	●	◒
Excavation/Incineration and Disposal	4	●	●	●	●	●	●	1,400	●	●
Excavation and Disposal	5	●	●	●	◒	◒	●	300	●	●
Capping or Excavation and Disposal	6	●	●	●	◒	●	●	32,000	●	◒
Removal/Recycle/Disposal	7	●	●	●	●	●	●	200	●	●
Total of All SRUs								84,000		

Ranking Key: ● Fully meets criteria ◒ Partially meets criteria

○ Does not meet criteria

8.3 Groundwater Operable Unit

There are currently no human or ecological receptors of the groundwater within the GRU1, GRU2, and GRU3, and therefore no pathway and no exposure scenario. .

All groundwater-related remedial actions and evaluations are considered final in this ROD.

8.3.1 GRU1: Explosives in Groundwater – LAP Area

The alternatives evaluated for this GRU are:

- Alternative 1: No Action
- Alternative 2: Limited Action
- Alternative 3: Pump and Treat by Carbon Adsorption

Following is a summary of the comparative analysis of these alternatives.

Overall Protection to the Human Health and the Environment

Alternative 1 does not provide adequate overall protection of human health, because complete pathways for groundwater exposure at any of the sites may exist. Alternative 2 protects human health and the environment through the use of GMZs and deed restrictions as well as by providing groundwater and surface water quality data that can be used to evaluate the rate of natural attenuation. This long-term monitoring data will allow risk-based decisions to be made regarding currentand future use of the sites, as well as indicate the current status and any trends in contaminant concentrations as a result of natural degradation and dispersion processes. Alternative 3 protects human health and the environment through the use of GMZs and deed restrictions. By recovering and treating groundwater. Alternative 3 reduces the overall risk associated with all the sites in the event that exposure pathways for groundwater are completed. This alternative is therefore protective of human health and the environment, both currently and in the future.

Compliance with Applicable or Relevant and Appropriate Requirements

Alternative 2 and Alternative 3 will comply with the ARARs. Because RGs are exceeded and no corrective actions are included under Alternative 1, this alternative violates 35 IAC 620.

Long-term Effectiveness and Permanence

Alternative 1 partially meets this criterion. Groundwater currently poses no risk to human health at GRU1 because of the lack of complete exposure pathways. However, there are no controls implemented under this alternative, so the adequacy and reliability of controls cannot be evaluated.

Alternatives 2 and 3 fully meet the long-term effectiveness and performance criteria. The Limited Action is part of a groundwater management program that permits a periodic and reliable check on contaminant movement and characteristics. This alternative will monitorcontaminant natural attenuation on a regular basis. As a result, appropriate action can be taken ifnecessary. Alternately, the scope of monitoring can be reduced as natural processes reduce contaminant concentrations.

Alternative 3 reduces the concentrationof contaminants more rapidly to the RGs than Alternative 2. The controls are considered reliable and adequate for the protection of human health and the environment.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 1 does not reduce the toxicity, mobility, or volume of contaminants or contaminated media. The concentration of explosives in groundwater will decrease naturally, provided that the source is removed. However, the rate of this decrease cannot be accurately predicted.

Alternative 2 will decrease the toxicity of explosives by lowering their concentrations via physical processes such as dilution and dispersion. Natural attenuation may reduce the mobility through the adsorption of contaminants to the soil and rock. Limited Action alternative may also decrease the volume of explosives through destructive processes such as biodegradation or biotic transformation. Enhancing these processes with phytoremediation may also reduce the toxicity and mobility of contaminants at some sites if this process is found to be effective.

Alternative 3 will reduce the toxicity and volume of contaminants in groundwater by removing contaminated groundwater. The extraction of groundwater will encourage nearby groundwater to flow to the extraction wells or trenches, limiting the mobility of the contaminants and discouraging further migration or discharge to nearby streams.

Short-term Effectiveness

Alternative 1 partially meets this criterion. Because no remedial actions are taken under this alternative, there are no short-term impacts on community or worker health or the environment from the construction or implementation activities. RGs will be achieved by this alternative via the mechanisms of natural attenuation, dilution, and dispersion. The time to reach the RGs can not be accurately estimated.

Alternative 2 will have minimal short-term impacts on worker or community health or on the environment. RGs will be achieved by this alternative via the mechanisms of natural attenuation. The time to reach the RGs varies for different sites and is dependent upon initial contaminant concentrations and the hydrogeological characteristics of the aquifers.

Alternative 3 will cause minimal impacts on the community. Because implementation of carbon adsorption treatment potentially involves off-site transportation of contaminated waste, its implementation may present a short-term impact to the community in the event of a release. The time to reach the RGs varies for different sites, although this alternative will achieve RGs more quickly than Alternative 2.

Implementability

Alternative 1 is readily implementable. No construction-related implementation considerations are associated with the No Action alternative. No permits or other specific administrative/regulatory approvals are needed with the No Action alternative.

Implementation of Alternative 2 requires construction of monitoring wells. The installation of new monitoring wells is easily implemented. Most wells are already installed and long-term monitoring is routine and does not affect other remedial actions that may occur on-site. The technology requirements for monitoring are low and involve widely adopted standard industry practices. Continued use of the wells for periodic sampling will pose no institutional or regulatory problems. Establishment of the GMZs would require the IEPA's approval. Fencing and warning signs are readily available, and deed restrictions require filing of required paper-work and forms.

Implementation of the Alternative 3 will require some construction activities, especially at Site Ll. The potential difficulty in operation of the carbon adsorption system may be related to the relatively high levels of minerals found in the groundwater of the region. Several minerals may precipitate and clog the carbon filters. It is also likely that Alternative 3 will have to rely on natural attenuation to achieve RGs because pump and treatment technologies usually lose their effectiveness prior to achieving RGs.

Cost
The following estimated cost includes capital, operational, and maintenance for all alternatives. These are present worth costs and are adjusted for the length of time to complete each alternative.

Alternative 1:	No Action	$ 0
Alternative 2:	Limited Action	$ 530,000
Alternative 3:	Pump and Treat by Carbon Adsorption	$ 3,800,000

State Acceptance
The IEPA concurs with the acceptability of and prefers Alternative 2 based on this alternative complying with the ARARs.

Community Acceptance
Comments received during the Public review period and from the January 8, 1998, Public Meeting were transcribed and are included in the Responsiveness Summary of this document. Responses to these comments are also included in the Responsiveness Summary. Generally, these comments were positive in nature. There is a concern and request from the community to expedite the remediation process. In general, the community appears to concur with the selected remedy.

8.3.1.1 Summary Evaluation of Alternatives for GRU1

Table 8-9 compares the alternatives considered for GRU1 with respect to the nine CERCLA evaluation criteria. The detailed analysis of alternatives for the GRU1 determined that the No Action alternative will not comply with the Illinois groundwater regulations. If no action is taken, the potential remains for undetected migration of and human exposure to contaminated groundwater. The threshold criteria would be met by the Limited Action alternative or the Pump and Treat by Carbon Adsorption alternative. Each will reduce the risk of direct contact with the contaminants in the groundwater of GRU1. All alternatives will benefit by the treatment or removal of contaminated soil that is the primary source for continuing groundwater contamination.

The Limited Action is the recommended alternative for the following reasons. First, the actual risk of direct exposure to the shallow groundwater is very limited in GRU1 because most of the contamination resides in the glacial drift aquifer that is not used as a water supply source. In addition, data and modeling indicates that the plumes will not migrate and pose risks to human health or the environment. It is also likely that the Pump and Treat by Carbon Adsorption alternative would need to rely on natural attenuation. This is because the low yield of the glacial drift aquifer makes it difficult to effectively withdraw groundwater. Case histories have shown that such systems lose their effectiveness prior to reaching RGs. In light of these reasons, the higher cost of the Pump and Treat by Carbon Adsorption alternative over the Limited Action alternative does not appear to be justified, given that the Limited Action alternative will achieve the RGs.

Table 8-9: Evaluation of Remedial Alternatives for GRU1 (Explosives in Groundwater – LAP Area)

Remedial Alternative	Selected Alternative	Evaluation Criteria: Threshold — 1. Overall Protection of Human Health and the Environment	2. Compliance with ARARs	Balancing — 3. Long-Term Effectiveness and Permanence	4. Reduction in Toxicity, Mobility or Volume Through Treatment	5. Short Term Effectiveness	6. Implementability	7. Cost (Net Present Worth in $1,000)	Modifying — 8. State Acceptance	9. Community Acceptance
1. No Action		○	○	◒	◒	◒	●	0	○	NA
2. Limited Action	✔	●	●	●	◒	●	●	530	●	◒
3. Pump and Treat with Carbon Adsorption		●	●	●	●	◒	◒	3,800	●	◒

Ranking Key: ● Fully meets criteria ◒ Partially meets criteria ○ Does not meet criteria

Notes: NA – Not addressed by public comments

All remedial actions are final for GRU1.

8.3.2 GRU2: Explosives and Other Contaminants in Groundwater – MFG Area

The alternatives evaluated for this GRU are:

Alternative 1: No Action
Alternative 2: Limited Action
Alternative 3: Pump and Treat with Bioreactor
Alternative 4: Pump and Treat by Carbon Adsorption
Alternative 5: Pump and Treat by UV Oxidation/Carbon Adsorption

Following is a summary of the comparative analysis of these alternatives.

Overall Protection to the Human Health and the Environment

Alternative 1 does not meet this criterion. The potential pathways for human exposure are ingestion by industrial workers and exposure of construction workers during intrusive work, and the presence of groundwater above the ground surface at certain locations of M6.

Alternative 2 will provide protection of human health by restricting use and possible contact with affected groundwater. The process of natural attenuation will be closely monitored through the GMZ program to ensure achievement of the RGs.

Alternatives 3, 4, and 5 will be effective in providing protection to human health and the environment. They provide for removal of contaminated groundwater and subsequent treatment to destroy the contaminants. This will result in the attainment of the RGs and hence protection to human health and the environment. Alternatives 3,4, and 5 also provide protection to human health and the environment through the use of GMZs and deed restrictions.

Compliance with Applicable or Relevant and Appropriate Requirements

Alternative 1 will not comply with the chemical-specific ARARs since reduction of the contaminant concentrations to the RGs through natural attenuation may not occur, even if it does occur, in a reasonable length of time.

Altenative 2 will comply with action- and location-specific ARARs, since minimal intrusive field activities will be undertaken during the construction of fences and installation of monitoring wells. There are no Federal or State regulations specifying cleanup levels for explosives in groundwater. Alternative 3, 4, and 5 will comply with the ARARs.

Long-term Effectiveness and Permanence

Alternative 1 will not result in the reduction of the contaminants concentrations except through natural attenuation. Because there are no measures that will limit exposure or monitor potential off-site migration, the No Action alternative will not be effective in preventing potential impact of the constituents to human health and the environment.

Alternative 2 assumes that the removal or remediation of sources will be performed. Following the remediation, the long-term risks associated with continued contamination in the underlying groundwater will be minimized. Residual contamination will be monitored through a long-term program under the GMZs. A reduction of contaminant levels in the groundwater will occur via natural attenuation processes. Alternative 3, 4, and 5 will provide long-term protection of human health and the environment because they actively remove the groundwater and treat the contaminants. These processes are irreversible and represent a high degree of permanence.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 1 does not reduce the toxicity, mobility, or volume of contaminants or contaminated media. The concentration of explosives in groundwater will decrease naturally, provided that the source is removed. However, the rate of this decrease cannot be accurately predicted.

Alternative 2 will decrease the toxicity of explosives by lowering their concentrations via physical processes such as dilution and dispersion. Natural attenuation may reduce the mobility through the adsorption of contaminants to the soil and rock. Limited Action alternative may also decrease the volume of explosives through destructive processes such as biodegradation or biotic transformation. Enhancing these processes with phytoremediation may also reduce the toxicity and mobility of contaminants at some sites if this process is found to be effective.

Alternative 3, 4, and 5 will result in a significant reduction in the toxicity, mobility and volume of the contaminated groundwater.

Short-term Effectiveness

Alternative 1 will not create additional environmental impact. The pathways for human exposure will remain the same. Because no remedial activities will be undertaken, there will be no short-term impacts associated with construction or other site activities.

Alternative 2 will result in no additional environmental impact. Since the area is proposed for industrial use, potential exists for human exposure to the contaminated water in the wetland area of M6. Because Limited Action alternative will be undertaken, there will be minimal short-term impacts to remedial workers during the construction and implementation period.

Alternative 3, 4, and 5 will result in short-term exposure of workers to the contaminated groundwater. Another short-term impact may be posed to the community and the environment during the transportation of spent carbon. There may be minimal short-term impacts to industrial workers during the construction phase for Alternative 3.

Implementability
Alternative 1 alternative is readily implementable. There are no technologies to be employed in this alternative. Alternative 2 is easily implementable. Existing monitoring wells will be used for sampling and the installation of new monitoring wells wfll involve conventional techniques. Establishment of the GMZs would require the IEPA's approval. Fencing and warning signs are readily available, and deed restrictions require filling of required paperwork and forms.

Alternative 3 is not a widely used technology and it does not have an established record of successful full-scale application. Design of the system will require some specialized engineering skills and treatability and pilot studies will be needed to ensure attainment of anticipated performance.

Alternative 4 and 5 are fairly easy to implement. The only practical physical problem that may be encountered in construction is common to any system of centralized groundwater treatment. Existing structures and piping may present problems in laying out a system or collection lines, and the construction of over two miles of collection trenches may pose operational difficulties.

Cost
The following estimated cost includes capital, operational, and maintenance for all alternatives. These are present worth costs and are adjusted for the length of time to complete each alternative.

Alternative 1:	No Action	$ 0
Alternative 2:	Limited Action	$ 3,300,000
Alternative 3:	Pump and Treat with Bioreactor	$ 13,700,000
Alternative 4:	Pump and Treat by Carbon Adsorption	$ l6,500,000
Alternative 5:	Pump and Treat by UV Oxidation/Carbon Adsorption	$ 16,400,000

State Acceptance
The IEPA concurs with the acceptability of and prefers Alternative 2 based on this alternative complying with the ARARs.

Community Acceptance
Comments received during the Public review period and from the January 8, 1998, Public Meeting were transcribed and are included in the Responsiveness Summary of this document. Responses to these comments are also included in the Responsiveness Summary. Generally, these comments were positive in nature. There is a concern and request from the community to expedite the remediation process. In general, the community appears to concur with the selected remedy.

8.3.21 Summary Evaluation of Alternatives for GRU2
Table 8-10 compares the alternatives considered for GRU2 with respect to the nine CERCLA evaluation criteria. The No Action alternative will not comply with the Illinois groundwater regulations and it does

not meet the threshold criteria. The threshold criteria will be met by each of the other alternatives. All alternatives would also benefit from the removal of contaminated soil because this action will remove the primary source for continuing groundwater contamination.

Limited Action is the recommended alternative because most of the contamination resides in the glacial drift aquifer that is not used as a water supply. In addition, the groundwater pumping system required for the other alternatives might be difficult to design, construct, and operate. This system may also not be able to effectively withdraw groundwater from the glacial drift aquifer because of its low permeability. Therefore, these alternatives would also have to rely on natural attenuation to achieve RGs. Testing, groundwater monitoring, and modeling data show that the plumes will not migrate and pose risks to human health and the enviromnent; therefore, the Limited Action alternative provides a more cost effective means of achieving the RGs as opposed to any of the pump and treatment alternatives.

Table 8-10: Evaluation of Remedial Alternatives for GRU2 (Explosives and Other Contaminants in Groundwater – MFG Area)

		Evaluation Criteria								
		Threshold		*Balancing*					*Modifying*	
Remedial Alternative	Selected Alternative	1. Overall Protection of Human Health and the Environment	2. Compliance with ARARs	3. Long-Term Effectiveness and Permanence	4. Reduction in Toxicity, Mobility or Volume Through Treatment	5. Short Term Effectiveness	6. Implementability	7. Cost (Net Present Worth in $1,000)	8. State Acceptance	9. Community Acceptance
1. No Action		○	○	○	◒	◒	●	0	○	NA
2. Limited Action	✔	●	●	●	◒	●	●	3,300	●	◒
3. Pump and Treat with Bioreactor		●	●	●	●	◒	◒	13,700	●	◒
4. Pump and Treat with Carbon Adsorption		●	●	●	●	◒	◒	16,500	●	◒
5. Pump and Treat with UV Oxidation/ Carbon Adsorption		●	●	●	●	◒	◒	16,400	●	◒

Ranking Key: ● Fully meets criteria ◒ Partially meets criteria ○ Does not meet criteria

Notes: NA – Not addressed by public comments

All remedial actions are final for GRU2.

8.3.3 GRU3:Volatile Organic Compounds (VOCs) in Groundwater–MFG Area

The alternatives evaluated for this GRU are:

Alternative 1: No Action
Alternative 2: Limited Action
Alternative 3: In-Situ Bioremediation
Alternative 4: Pump and Treat by Air Stripping/Vapor-Phase Carbon Adsorption
Alternative 5: Pump and Treat by Carbon Adsorption
Alternative 6: Pump and Treat by UV Oxidation

Following is a summary of the comparative analysis of these alternatives.

Overall Protection to the Human Health and the Environment

Alternative 1 does not protect the environment from existing contamination that affects the quality of the shallow groundwater. Alternative 2 will provide protection of human health by restricting use and possible contact with contaminated groundwater. Natural attenuation, including biodegradation by indigenous microorganisms, of the benzene and toluene is likely to take place. This alternative will entail close monitoring of these processes, thereby providing adequate means of environment protection.

Alternatives 3, 4, 5, and 6 will be quite effective in providing protection to human health and the environment. They involve the removal and treatment of thecontaminated groundwater. This will result in a reduction of benzene and toluene to the RGs, thus attaining protection of the environment as well. Alternatives 3, 4, 5, and 6 also provide the protection to human health and the environment through the use of GMZs and deed restrictions.

Compliance with Applicable or Relevant and Appropriate Requirements

Alternative 1 does not comply with chemical-specific ARARs. The benzene and toluene concentration in the groundwater is currently above the regulatory levels for drinking water standards. Compliance with the action- and location-specific ARARs will not be a relevant criterion since no remedial action will take place.

Alternative 2 will be implemented in a way that will comply with the action- and location-specific ARARs. Through natural attenuation, compliance with the chemical-specific ARARs is expected over time. Alternatives 3, 4, 5, and 6 will comply with chemical-, location-, and action-specific ARARs.

Long-term Effectiveness and Permanence

Alternative 1 will not reduce the levels of contamination nor will the alternative prevent contamination from continuing to migrate. Natural attenuation of constituents over time is the only protection provided under this alternative.

Alternative 2 will be effective in attaining the RGs through placement of (deed restrictions and implementing close monitoring of natural attenuation processes in the GMZs. This alternative will also reduce the levels of contamination by the process of natural attenuation.

Alternatives 3, 4, 5, and 6 will provide a high level of long-term effectiveness. A long-term groundwater monitoring program will be implemented to ensure continued protection of human health and the environment during implementation.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 1 will reduce toxicity, mobility, and volume of the groundwater contamination. Since no treatment technology is applied with this alternative, the only mechanism that would result in a reduction of toxicity, mobility, or volume of benzene and toluene contaminated groundwater is natural attenuation. Intrinsic biodegradation of benzene and toluene has been well documented, therefore, it is anticipated to satisfy this criterion over time. However, there will be no monitoring and there will be no way to assess the effectiveness of this alternative.

Alternative 2 will partially satisfy this criterion. Since no treatment technology is applied with this alternative, the mechanism that will result in a reduction of toxicity, mobility, and volume of benzene and toluene, is via natural attenuation, including biodegradation. These processes are monitored during the implementation of this alternative.

Alternatives 3, 4, 5, and 6 will result in the reduction of benzene and toluene concentrations in the groundwater. Once treated, the groundwater remediation is considered complete because the treatment process is irreversible.

Short-term Effectiveness

Alternative 1 will partially satisfy this criterion. This alternative will not reduce or remove the toluene concentration in a short period of time. Under the No Action alternative no remedial actions will be implemented, therefore, there are no short-term implementation impacts associated with this alternative.

Alternative 2 will fully satisfy this criterion. There will be minimal short-term impacts to human health and the environment during the remedial action because limited actions will involve only construction of fences and monitoring wells and the associated monitoring and management activities.

Alternatives 3, 4, 5, and 6 will result in short-term exposure of workers to the contaminated groundwater. However, because limited construction activities and relatively short duration are required, there is very little short-term impact to workers.

Implementability

Alternatives 1 and 2 are readily implementable. There are no technologies to be employed in these alternatives. In Alternative 2, establishment of the GMZs would require the IEPA's approval. Fencing and warning signs are readily available, and deed restrictions require filling of required paperwork and forms. Alternatives 3, 4, 5, and 6 are easy to implement. The required equipment can be procured from the commercial manufactures. Construction of the necessary systems will require conventional technology. However, the low permeability of the alluvial till will limit the effectiveness of injecting air or pumping water.

Cost

The following estimated cost includes capital, operational, and maintenance for all alternatives. These are present worth costs and are adjusted for the length of time to complete each alternative.

Alternative 1:	No Action	$ 0
Alternative 2:	Limited Action	$ 700,000
Alternative 3:	In-Situ Bioremediation	$ 2,100,000
Alternative 4:	Pump and Treat with Air Stripping/ Vapor-Phase Carbon Adsorption	$ 2,100,000
Alternative 5:	Pump and Treat with Carbon Adsorption	$ 2,100,000
Alternative 6:	Pump and Treat with UV Oxidation	$ 2,400,000

State Acceptance
The IEPA concurs with the acceptability of and prefers Alternative 2 based on this alternative complying with the ARARs.

Community Acceptance
Comments received during the Public review period and from the January 8, 1998, Public Meeting were transcribed and are included in the Responsiveness Summary of this document. Responses to these comments are also included in the Responsiveness Summary. Generally, these comments were positive in nature. There is a concern and request from the community to expedite the remediation process. In general, the community appears to concur with the selected remedy.

8.3.3.1 Summary of Evaluation for GRU3

Table 8-11 compares the alternatives considered for GRU3 with respect to the nine CERCLA evaluation criteria. The No Action alternative was not recommended because it will not comply with Illinois groundwater regulations and does not meet the threshold criteria.

Limited Action is the recommended alternative because the low permeability of the glacial drift will make injection of air and pumping of water difficult and limit the effectiveness of Alternative 3 through 6. In addition, case studies demonstrate that natural attenuation would likely be required to achieve RGs under Alternative 3 through 6 because these systems lose their effectiveness over time. Existing modeling data show that two plumes will not migrate and pose risks to human health and the environment. Therefore, the Limited Action alternative provides a more cost-effective means of achieving the RGs as opposed to the other alternatives.

Table 8-11: Evaluation of Remedial Alternatives for GRU3 (VOCs in Groundwater – MFG Area)

		Evaluation Criteria								
		Threshold		*Balancing*					*Modifying*	
Remedial Alternative	Selected Alternative	1. Overall Protection of Human Health and the Environment	2. Compliance with ARARs	3. Long-Term Effectiveness and Permanence	4. Reduction in Toxicity, Mobility or Volume Through Treatment	5. Short Term Effectiveness	6. Implementability	7. Cost (Net Present Worth in $1,000)	8. State Acceptance	9. Community Acceptance
1. No Action		○	○	◒	◒	◒	●	0	○	NA
2. Limited Action	✓	●	●	●	◒	●	●	700	●	◒
3. In-Situ Bioremediation		●	●	●	●	●	●	2,100	●	◒
4. Pump and Treat with Air Stripping/ Vapor-Phase Carbon Adsorption		●	●	●	●	●	●	2,100	●	◒
5. Pump and Treat with Carbon Adsorption		●	●	●	●	●	●	2,100	●	◒
6. Pump and Treat with UV Oxidation		●	●	●	●	●	●	2,400	●	◒

Ranking Key: ● Fully meets criteria ◒ Partially meets criteria ○ Does not meet criteria

Notes: NA – Not addressed by public comments

All remedial actions are final for GRU3.

8.3.4 Summary of Selected Remedies for all GRUs

Table 8-12 presents a summary evaluation of selected remedies for each of the three GRUs. The net present cost value of remedial actions for the GOU is estimated to be $ 4,530,000.

Table 8-12: Summary of Recommended Remedial Alternatives for All GRUs—LAP and MFG Areas

		Evaluation Criteria								
		Threshold		*Balancing*					*Modifying*	
Remedial Alternative	GRU	1. Overall Protection of Human Health and the Environment	2. Compliance with ARARs	3. Long-Term Effectiveness and Permanence	4. Reduction in Toxicity, Mobility or Volume Through Treatment	5. Short Term Effectiveness	6. Implementability	7. Cost (Net Present Worth in $1,000)	8. State Acceptance	9. Community Acceptance
Limited Action	1	●	●	●	◒	●	●	530	●	◒
Limited Action	2	●	●	●	◒	●	●	3,300	●	◒
Limited Action	3	●	●	●	◒	●	●	700	●	◒
Total of All GRUs								4,530		

Ranking Key: ● Fully meets criteria ◒ Partially meets criteria

○ Does not meet criteria

8.4 Cost Summary for Selected Remedies

Table 8-13 provides component costs (capital, annual operation and maintenance, and site closeout costs) for each selected remedy. The component costs are discounted (at 7% per year) and aggregated to provide total costs (in NPV). The years shown in Table 8-13 are used in the economic analyses of the projects. They are the projected years, from initial implementation of remedial design through the completion of a remedial action – except in the case where a remedial action may take more than 30 years. In that case, 30 years is used as a standard economic projection horizon.

Appendix B provides similarly detailed cost breakdowns for all remedial alternatives considered in this ROD, not just for the selected alternatives.

TABLE 8-13: Summary of Estimated Costs of Selected Remedial Alternatives for All SRUs and GRUs

Remedial Unit and Sites	**Selected Alternative?**	**Alternative**	**JOAAP Area / Specific Sites**	**Volume** *(CY or MG)*	**Total Cost** *(NPV)*	**Yrs.** *(1)*	**Component Costs (*in current year value*)**		
							Capitol	**Annual O&M**	**Site Closeout**
SRU1: Explosives	Yes	3: Bioremediation	All SRU1	151,480	$ 39,300,000	3	$ 13,800,000	$ 9,400,000	$ 900,000
SRU2: Metals	Yes	4: Excavation and Disposal	All SRU2	22,940	$ 4,000,000	1	$ 4,000,000	$ -	$ -
SRU3: Explosives and Metals		3: Bioremediation	MFG SRU3	13,500	$ 4,000,000	3	$ 1,300,000	$ 1,000,000	$ 96,000
	Yes	5: Excavation and Disposal	LAP SRU3	17,420	$ 2,800,000	1	$ 2,800,000	$ -	$ -
SRU4: PCBs	Yes	5: Excavation/Incineration and Disposal	All SRU4	3,416	$ 1,400,000	1	$ 1,400,000	$ -	$ -
SRU5: Organics	Yes	6: Excavation and Disposal	All SRU5	2,410	$ 3,00,000	1	$ 300,000	$ -	$ -
SRU6: Landfills		3: Capping	L3, M11, M13	323,600	$ 19,900,000	30	$ 17,200,000	$ 220,000	$ 80,000
	Yes	4: Excavation and Disposal	L4, M1, M9	366,200	$ 12,100,000	1	$ 12,100,000	$ -	$ -
SRU7: Sulfur	Yes	3: Remove/Recycle/Disposal	All SRU7	7,500	$ 200,000	1	$ 200,000	$ -	$ -
GRU1: Explosives -- LAP Area	Yes	2: Limited Action	All GRU1	87	$ 530,000	30	$ 50,000	$ 40,000	$ -
GRU2: Explosives and Other Contaminants -- MFG Area	Yes	2: Limited Action	All GRU2	542	$ 3,300,000	30	$ 900,000	$ 190,000	$ 14,000
GRU3: Volatile Organic Compounds -- MFG Area	Yes	2: Limited Action	All GRU3	3	$ 700,000	30	$ 70,000	$ 50,000	$ 30,000
Total SRUs				908,466 CY	$ 84,000,000		$ 53,000,000	$ 11,000,000	
Total GRUs				632 MG	$ 4,530,000		$ 1,020,000	$ 280,000	*See Note (2)*
Grand Total					$ 88,530,000		$ 54,020,000	$ 11,280,000	

Notes: (1) Years show the estimated time to complete from the first year of implementation through completion of operations and maintenance. Maximum of 30 years is shown for purpose of the economic analysis presented in table. Time to reach RGs may exceed the 30 years shown.

(2) Summary of component costs is appropriate only if all have been discounted to same year values (such as present year values).

[END OF SECTION]

9 SELECTED REMEDIES

Based upon consideration of the requirements of CERCLA, the detailed evaluation of alternatives, and public comments, the Army, with the concurrence of the USEPA and IEPA, has selected the following remedies for the seven soil remedial units and three groundwater remedial units.

Table 9-1: Selected Remedies and Costs of Clean up for SRUs/GRUs.

Sites	Selected Remedy	Costs of Clean up
SRU1: Explosives in Soil	Bioremediation	$ 39,300,000
SRU2: Metals in Soil	Excavation and Disposal	$ 4,000,000
SRU3: Explosives and Metals in Soil	Bioremediation and Disposal, and Excavation and Disposal	$ 6,800,000
SRU4: PBCs in Soil	Excavation/Incineration and Disposal	$ 1,400,000
SRU5: Organics in Soil	Excavation and Disposal	$ 300,000
SRU6: Landfills	Capping and Excavation and Disposal	$ 32,000,000
SRU7: Sulfur	Removal and Recycle or Disposal	$ 200,000
GRU1: Explosives in Groundwater LAP Area	Limited Action	$ 530,000
GRU2: Explosives and Other Contaminants in Groundwater MFG Area	Limited Action	$ 3,300,000
GRU3: Volatile Organic Compounds (VOCs) in Groundwater MFG Area	Limited Action	$ 700,000
Grand Total Costs	Soil Remedial Units Groundwater Remedial Units Remedial Units Total	$ 84,000,000 $ 4,530,000 $ 88,530,000

These selected alternatives include the design and implementation of several remedial actions. The primary objective of the final remedial actions is to effectively mitigate, minimize threats to, and provide adequate protection of human health and the environment. To meet this objective, the Army developed remedial action objectives (RAOs) for the Soil and Groundwater OUs. These RAOs for final actions are summarized as:

1. Clean up contaminants to the site-specific and chemical-specific remediation goals (RGs);
2. Prevent human and environmental exposure to contamination at concentrations above the RGs;
3. Eliminate soil contamination as a continuing source of groundwater contamination;
4. Prevent migration of contaminants; and
5. Actions will not leave behind any RCRA characteristic wastes, except those contained within the capped landfills of SRU6.

The objectives of the interim remedial actions are summarized as:

1. Eliminate soil contamination as a continuing source of groundwater contamination;
2. Prevent migration of contaminants;

The implementation time to reach these goals will vary between each SRU/GRU and will be given later in this section. This time estimate includes the treatment system design and review, and system construction and/or implementation. Long term monitoring is not a part of this estimate. Although this section presents details of the selected remedy, some changes with the USEPA and IEPA approval may be made based on the remedial design and construction process.

Performance Objectives: The selected remedial action alternatives are expected to be able to meet the stated RAOs. To do this, they must perform properly, must be protective of human health and the environment, and must comply with all applicable ARARs. Technology-specific performance objectives will be specified in the Remedial Design Phase.

Some of the selected alternatives have common remedial actions; therefore, rather than repeating the description of these remedial actions under each section, these common actions will be described first for the soil SRUs and then for the groundwater GRUs before referring to these actions under each SRU and GRU description.

9.1 Soil Operable Unit

9.1.1 Common Soil OU Action

The selected remedies for the soil treatment contain several common actions. Exceptions will be noted as the common elements are described. With the exception of capping, all the selected remedies include excavation, treatment, or disposal of soil containing contaminant concentrations above the RGs. Following is a description of the common actions that are included in the selected remedy.

9.1.1.1 Building Demolition

Where appropriate, some existing building components and structures may need to be demolished prior to excavating contaminated soil. The RI/FS identifies these buildings. These buildings may be removed and salvaged as part of the ongoing liquidation contract for JOAAP. If building debris cannot be salvaged, it will be disposed at the future proposed WCLF or at an existing permitted facility. The disturbance to soil will be minimized during building demolition activities.

9.1.1.2 Soil Excavation, Transportation, and Confirmatory Sampling

Contaminated soil will be excavated from the various subareas within each site, loaded into dump trucks, and transported to either a central treatment area (or treatment areas) for stockpiling (if treatment is part of the remedy) or for disposal. These trucks must comply with the Illinois Department of Transportation Regulations if the trucks travel on State roads. Conventional earthmoving equipment will be used for excavation. Soil excavation will continue until confirmatory sampling confirms that concentration levels in the soil meet RGs.

The limits of excavation will be determined primarily based on the RI/FS maps/data and by visual observation of stained soil. These limits will be confirmed with approval from the USEPA and IEPA using field screen tests, with final confirmatory samples (including both COC and TCLP tests, as appropriate) analyzed by a laboratory.

If unexploded ordnance (UXO) is encountered, it will be screened and removed for open burn /detonation or for off-site incineration at a permitted facility. If raw TNT is encountered, it will be processed for treatment or disposal at a permitted off-site facility, processed to be blended back for treatment at JOAAP or turned over to the Bureau of Alcohol, Tobacco and Firearms (for reuse in training).

9.1.1.3 Soil Preparation

This action is common to all alternatives where active treatment occurs. After reaching the treatment area, contaminated soil will be stored in a stockpile area. Soil will be screened and blended within the stockpile area. Blending of hot-spot soil with less contaminated soil will be conducted to homogenize the soil for feed into the treatment system. Debris and large stones will be removed using a series of shaker/separator units. Debris and large stones will be stockpiled for possible pressure washing and will be reused or properly disposed. UXO or raw TNT encountered in soil preparation will be handled as described in Section 9.1.1.2.

All trucks used to transport soil will be routed through a wheel wash prior to exiting the treatment area. Wash water from the trucks and from the pressure wash operation will be containerized and used as makeup water in the treatment process or containerized for off-site disposal.

If the selected remedy does not involve active treatment (e.g., Excavation and Disposal), excavated soil will not be transported to a treatment area. Soil will be excavated and may be screened by a mobile screener/separator for debris and large stones prior to transportation. UXO and raw TNT will be handled as mentioned earlier.

9.1.1.4 Backfilling, Regrading, and Revegetating Excavated Areas

Excavated areas will be backfilled as required for safety, to prevent ponding, and to promote surface drainage. The source of the backfill soil will be from an on-site borrow location. Some treated soil can also be used as clean backfill at any on-site location that does not require structural fill. Depending upon the time schedule for excavation, this may or may not be the same location from which the soil was removed. Backfilled areas will be regraded to conform to the surrounding topography. Most of these backfilled areas will be revegetated with plants consistent with the future land use. For those areas designated to become part of the Midewin National Tallgrass Prairie, backfilling and reseeding of excavated areas and identifying sources of borrow will be done in consultation with USDA/FS. Surface water runoff from remedial action sites will be monitored at specified points to ensure compliance with NPDES and Illinois water quality standards.

The substantive requirements of ARARs relating to jurisdictional wetlands will be met during the remedial design and remedial action phases.

9.1.1.5 Soil Disposal

The Army will use the following options that exist for disposal of treated or untreated soils. Soils will be tested as appropriate and in accordance with procedures approved by USEPA and IEPA to determine whether the soils are RCRA hazardous wastes and whether RGs are exceeded. Based on the results of these tests, the disposal options for the soils will be as follows:

1. All soils which are contaminated with RCRA hazardous wastes must be:
    - Disposed at a RCRA Subtitle C facility, or
    - Treated and disposed at a RCRA Subtitle C facility, or
    - Treated and disposed at a RCRA Subtitle D facility or may be used as subgrade or backfill, if the soils are not characteristically hazardous under RCRA, achieve RGs, and do not exceed LDRs under RCRA.

2. All soils which exceed RGs and are not RCRA hazardous waste must disposed as above or:
    - Disposed at a RCRA Subtitle D facility, or
    - Used as subgrade fill material in capped landfills at JOAAP.

3. All remaining soils can be disposed as above, or
    - Reused (e.g., as backfill)

These options are available for all soils except the PCB-contaminated soils in SRU4. Applicable final rule-making under RCRA may amend this section.

9.1.1.6 Institutional Controls --Deed Restrictions on Land and Soils

Deed restrictions have been developed or are being developed separately from this Record of Decision by the Army, USEPA, IEPA and the future land users. These deed restrictions will run with the land until removed by mutual agreement of the Army, USEPA, IEPA and the current landowner. The deed restrictions will be recorded with the Will County Recorder (302 N. Chicago Street, Joliet, IL 60432). Section 120(h)(3) of CERCLA defines precise requirements for the contents of deeds for property to be transferred from the Federal government, in which, hazardous or toxic substances were stored for greater than a year, or were released into the environment. Specifically, it states that: “in the case of any real property owned by the United States on which any hazardous substance was stored for one year or more, known to have been released, or disposed of, each deed entered into for the transfer of such property by the United States to any other person or entity shall contain—(A) to the extent such information is available on the basis of a complete search of agency files—(i) a notice of the type and quantity of such hazardous substances, (ii) notice of the time at which such storage, release, or disposal took place, and (iii) a description of the remedial action taken, if any, and (B) a covenant warranting that—(i) all remedial action necessary to protect human health and the environment with respect to any such substance remaining on the property has been taken before the date of such transfer, and (ii) any additional remedial action found to be necessary after the date of such transfer shall be conducted by the United States; and (C) a clause granting the United States access to the property in any case in which remedial action or corrective action is found to be necessary after the date of such transfer.

The objectives of these deed restrictions is to protect human health and the environment by (i) ensuring that land use is consistent with the requirements of PL104-106, and (ii) maintaining the integrity of the landfill caps at sites L3, M11 and M16 where caps have been placed. The restrictions that will be recorded to meet these objectives include but may not be limited to the following:

> Land in the areas designated for industrial park can not be used for residential use. Land designated for the USDA can not be used for industrial or residential use.

Section 9.3 addresses related institutional controls involving notification, enforcement, access and non-detrimental use. Section 9.2.1.2 addresses deed restrictions placed on groundwater use.

9.1.2 SRU: Explosives in Soil ö Bioremediation

Described below are the remediation actions under the Bioremediation remedy and the estimated treatment time and cost associated with this remedy. Some of the remedial actions were described in the common action section above and are only listed below. The Bioremediation remedy includes:

- Building Demolition *(Section 9.1.1.1);*
- Soil Excavation, Transportation, and Confirmatory Sampling *(Section 9.1.1.2);*
- Soil Preparation *(Section 9.1.1.3);*
- Bioremediation;
- Backfilling, Regrading, and Revegetating Excavated Areas *(Section 9.1.1.4);*
- Soil Disposal *(Section 9.1.1.5);*
- Treatment Area Decommissioning;
- Institutional Controls -Deed Restrictions on Land and Soils *(Section 9.1.1.6).*

Remedial actions at Sites L16, M5, M6 and M7 for SRU1 are considered final. Remedial actions at Sites L1, L7, L8, L9, L10, L14, M2 and M3 for SRU1 are considered interim.

During remedial design or remedial action, the Army will determine the extent of explosives contamination associated with storm sewer lines at Sites L7 through L10. Contamination above the RGs will be excavated and treated.

Some of the soils in SRU were contaminated by Resource Conservation and Recovery Act (RCRA) listed hazardous wastes, and as such "contain" these wastes. The Army based its detailed analysis of alternatives and selection of remedial technologies for these SRU1 soils on two determinations. First, media, such as soils, at JOAAP that were contaminated with RCRA listed hazardous wastes, are not themselves hazardous wastes unless they exhibit the characteristic for which the waste was listed. Second, once media contaminated with RCRA listed hazardous wastes are treated to below Remediation Goals (RGs), are not Toxic Characteristic Leaching Procedure (TCLP) hazardous wastes under RCRA, and do not exceed RCRA Land Disposal Restriction (LDR) concentrations, the media is no longer a RCRA hazardous waste.

9.1.2.1 Bioremediation

Approximately 151,480 cubic yards of explosive-contaminated soil will be treated using a Bioremediation treatment process. There are several bioremediation technologies that are capable of meeting and substantially exceeding the RGs. A technology demonstration project is underway to select the most appropriate technology for treating the JOAAP soil on the basis of cost, technical feasibility, environmental acceptability, and utility of the final treated material. For the purpose of cost estimate, windrow composting was selected as the bioremediation treatment process. This process has been proven on a full-scale operation. Composting is a treatment process where organic compounds are biologically degraded or transformed by mesophilic and thermophilic microorganisms. The composting process consists of mixing the waste material with an amendment or bulking agent to increase porosity, enhance air mass transfer into the system, and enhance the microbial population that degrades the explosives. Windrow composting will include three major steps: a) amendment materials preparation, b) windrow construction, and c) windrow operation. The bioremediation alternative is expected to treat the soil and reduce the explosive levels to below RGs. Based on the results of the kinetic evaluation performed for the UMDA study in 1991, over 99.5 percent reduction of explosives concentration can be achieved by using bioremediation.

One central treatment area is assumed to be constructed and soil from the different sites transported to that area. This treatment area will include a contaminated soil stockpile area, preparation area, treatment processes area, and a treated soil stockpile area. Run-off from rain and from the treatment itself will be controlled to prevent any contamination due to the treatment operation. Treated soil will be backfilled in excavated areas.

The USEPA and IEPA will approve the bioremediation technology selected. The plans developed by the Army or its contractors to monitor and evaluate the bioremediation remedy will be subject to review and approval by the USEPA and IEPA.

Post-treatment testing will be performed to ensure soil contaminant levels meet RGs.

9.1.2.2 Treatment Area Decommissioning

When the treatment of contaminated soil is completed, the treatment area and associated facilities will be disassembled, decontaminated, and salvaged, Any parts of the treatment facility that can not be salvaged or are not desired by the future owner will be disposed in the future proposed WCLF or at an existing permitted facility as construction debris. Any treatment residuals will also be sampled and reused or properly disposed.

9.1.2.3 Remedial Time and Cost

Once approval of the recommended alternative is received and funding obtained, the estimated time required for completion of cleanup activities at SRU1, using the assumptions of the FS conceptual designs, are:

- One (1) year for engineering design and treatment facility construction
- Three (3) years for excavation, treatment and disposal

Upon completion of the final remedial actions, no further cleanup action will be required for SRU1.

The total present worth of capital and annual costs of the bioremediation remedy is estimated to be $39,300,000. The total capital cost is $14,400,000, and the total annual cost is $9,000,000. Based on the RI/FS data, an estimated 151,480 cubic yards of soil will be treated.

9.1.3 SRU2: Metals in Soil ö Excavation and Disposal

Described below are the remedial actions under the Excavation and Disposal remedy and the treatment time and cost associated with this remedy. Some of the remedial actions were described in the common action section above and are only listed below. The Excavation and Disposal remedy will include:

- Soil Excavation, Transportation, and Confirmatory Sampling *(Section 9.1.1.2);*
- Soil Preparation *(Section 9.1.1.3);*
- Backfilling, Regrading, and Revegetating Excavated Areas *(Section 9.1.1.4);*
- Soil Disposal *(Section 9.1.1.5);* and
- Institutional Controls – Deed Restrictions on Land and Soils *(Section 9.1.1.6).*

Remedial actions at Site L11 for SRU2 are considered final. Remedial actions at Sites L2, L3, L5, L23A, M3, M4 and M12 for SRU2 are considered interim.

Approximately 22,940 cubic yards of metal-contaminated soil will be excavated and disposed. No raw TNT is expected to be present in the soil. Soils potentially containing UXO will be located, and the UXO removed and stockpiled for open burn/detonation or incineration at a permitted facility off-site. Otherwise, soil will not be screened, it will be excavated and disposed as specified in Section 9.1.1.5.

9.1.3.1 Remedial Time and Cost

The estimated completion time for remediating SRU2 is one (1) year including engineering design, excavation and disposal. Upon completion of the final remediation, no further cleanup actions will be required for SRU2. The total estimated present worth of capital and annual costs of the Excavation and Disposal remedy is$4,000,000.

9.1.4 SRU3: Explosives and Metals in Soil ö Bioremediation and Disposal, and Excavation and Disposal

Described below are the remediation actions for the Bioremediation and Disposal, and Excavation and Disposal remedies and the treatment time and cost associated with both remedies. Some of the remedial actions were described in the common action section above and are only listed below. The two remedies will include:

- Soil Excavation, Transportation, and Confirmatory Sampling (*Section 9.1.1.2*);
- Soil Preparation (*Section 9.1.1.3*);
- Treatment Determination;
- Bioremediation(*Section 9.1.2.1*);
- Backfilling, Regrading and Revegetating (*Section 9.1.1.4*);
- Soil Disposal (*Section 9.1.1.5*);
- Treatment Area Decommissioning (*Section 9.1.2.3*); and
- Institutional Controls - Deed Restrictions on Land and Soils (*Section 9.1.1.6*).

Remedial actions at Sites M5 and M6 for SRU3 are considered final. Remedial actions at Sites L2 and L3 for SRU3 are considered interim.

Some of the soils in SRU3 were contaminated by RCRA listed hazardous wastes, and as such "contain" these wastes. The Army based its detailed analysis of alternatives and selection of remedial technologies for these SRU3 soils on two determinations. First, media at JOAAP were contaminated with RCRA listed hazardous wastes, are not themselves hazardous wastes unless they exhibit the characteristic for which the waste was listed. Second, once media contaminated with RCRA listed hazardous wastes are treated to below RGs, are not TCLP hazardous wastes under RCRA, and do not exceed RCRA LDR concentrations, the media is no longer a RCRA hazardous waste.

9.1.4.1 *Treatment Determination.*

Approximately 15,700 cubic yards of explosive- and metal-contaminated soil will be excavated from sites M5 and M6 and approximately 17,420 cubic yards of explosive- and metals-contaminated soil will be excavated from sites L2 and L3. The Army will determine whether or not these soils should be treated prior to disposal, based on metal concentrations and explosive characteristics and concentrations in the soil. The following decision rules will be followed in this treatment determination for soils containing both explosives and metals contamination:

1. The Army will treat all soils that are RCRA hazardous waste based on explosives contamination in the soil. (An example is soils with explosives concentrations (> 100,000 ppm) so high that they are reactive).
2. The Army may treat all other soils. Treatment will be attractive if it improves the disposal options (such as allowing for disposal in a RCRA Subtitle D permitted landfill instead of a RCRA Subtitle C permitted landfill).

Applicable final rule-making under RCRA may amend this section.

9.1.4.2 Remedial Time and Cost

The estimated time required for remediating SRU3 is:

- One (1)year for engineering design.
- One (1) year for the process time to be coordinated with designing time of SRU1.
- One (1)year to Bioremediate and Dispose approximately 15,700 cubic yards of soil.
- One (1) year for the Excavation and Disposal of approximately 17,420 cubic yards of soil not requiring bioremediaton. (This step may run concurrently with either of prior two steps.)

The total present worth of capital and annual costs of the Bioremediation and Disposal remedy at sites M5 and M6 is estimated to be $4,000,000. The present worth of capital and annual costs of the Excavation and Disposal remedy at sites L2 and L3 is estimated to be $2,800,000.

9.1.5 SRU4: PCBs in Soil ö Excavation/Incineration and Disposal

Described below are the remediation actions under the Excavation/Incineration and Disposal remedy and the treatment time and cost associated with this remedy. Some of the remedial actions were described in the common action section above and are only listed below. The Excavation/Incineration and Disposal remedy will include:

- Structure Demolition (*Section 9.1.1.1*);
- Soil Excavation, Transportation, and Confirmatory Sampling (*Section 9.1.1.2*);
- Backfilling, Regrading, and Revegetating Excavated Areas (*Section 9.1.1.4*);
- Soil Incineration or Disposal; and
- Institutional Controls -Deed Restrictions on Land and Soils (*Section 9.1.1.6*).

Remedial actions at all sites for SRU4 are considered final.

9.1.5.1 Soil Incineration or Disposal

Approximately 3,500 cubic yards of PCB-contaminated soil will be excavated and disposed. No raw TNT or UXO is expected to be present in the soil. Depending on confirmatory sampling results, there are three different disposal options:

- If PCB levels in soil are below 50 ppm, then the soil will be disposed at RCRA Subtitle D permitted facility. The volume of soil with PCBs below 50 ppm concentrations is estimated to be approximately 1,000 cubic yards.
- If PCB levels in the soil are between 50 ppm and 500 ppm, then the soil will be disposed at a TSCA permitted landfill. The volume of soil with such PCB concentrations is estimated to be 650 cubic yards.
- If PCB levels are greater than 500 ppm, then the soil will be disposed off-site in accordance with TSCA (e.g., treated off-site at a TSCA permitted incinerator). The volume of soil with such PCB concentrations is estimated to be 1,850 cubic yards.

9.1.5.2 *Remedial Time and Cost*

The estimated time required for remediating SRU4is one year. The total present worth of capital and annual costs of the Excavation/Incineration and Disposal remedy is estimated to be $1,400,000.

9.1.6 SRU5: *Organics in Soil ö Excavation and Disposal*

Described below are the remediation actions under the Excavation and Disposal remedy and the treatment time and cost associated with this remedy. Some of the remedial actions weredescribed in the common action section above and are only listed below. The Excavation and Disposal remedy will include:

- Structure Demolition (*Section 9.1.1.1*);
- Soil Excavation, Transportation, and Confirmatory Sampling (*Section 9.1.1.2*);
- Backfilling, Regrading, and Revegetating Excavated Areas (*Section 9.1.1.4*);
- Soil Disposal (*Section 9.1.1.5*); and
- Institutional Controls - Deed Restrictions on Land and Soils (*Section 9.1.1.6*).

Remedial actions at Sites L1 and L5 for SRU5 are considered interim.

9.1.6.1 Soil Disposal

Approximately 2,410 cubic yards of organics-contaminated soil consisting mostly of non-hazardous total petroleum hydrocarbons will be excavated and hauled for disposal. O raw TNT or UXO is expected to be present in the soil.

9.1.6.2 Remedial Time and Cost

The estimated time required for remediating SRU5 is one year.

The total present worth of capital and annual costs of the Excavation and Disposal of approximately 2,410 cubic yards of organic contaminated soil is estimated to be $300,000.

9.1.7 SRU6: Landfills ö Capping or Excavation and Disposal

Described below are the remediation actions for the Capping or Excavation and Disposal remedies and the treatment time and costs associated with both remedies. Some of the remedial actions were described in the common action section above and are only listed below. The two remedies will include:

- Soil Excavation, Transportation, and Confirmatory Sampling (*Section 9.1.1.2*);
- Capping;
- Excavation and Disposal; and
- Institutional Controls.

Remedial actions at all sites for SRU6 are considered final.

Prior to implementation of this remedy, the Army will continue to maintain existing landfills M1 and M9.

9.1.7.1 Capping

The landfills in sites L3, M11, and M13 will be capped. These landfill surfaces will be regraded and smoothed before the construction of the caps. Regrading may require fill soil from an on-site borrow location, the product of a treatment process (SRU1, SRU3), or suitable soils from the SRU2 disposal activities.

RCRA Subtitle D caps will be constructed over M13 landfills because these landfills contain non-hazardous wastes. RCRA Subtitle C caps will be constructed over the L3 and M11 land fills because they contain hazardous wastes.

9.1.7.2 Excavation and Disposal

The landfills in sites L4, M1, and M9 will be excavated and disposed. Landfill materials will be excavated using conventional earthmoving equipment. Excavated areas will be graded and vegetated to be compatible with the intended land use. If necessary, excavated areas will be backfilled from an on-site borrow location. Excavated material will be tested prior to final disposal.

Based upon testing, excavated material will be classified and segregated as hazardous, non-hazardous, or recyclable. Based upon classification, lined trucks will transport the waste for ultimate disposal. If waste is considered hazardous then it will be disposed at a RCRA Subtitle C landfill, disposed. The inert ash at M1 and M9 is not a RCRA hazardous waste and may be disposed in a solid waste facility or otherwise offered for reuse. The Army is pursuing the option for reuse of the inert ash from sites M1 and M9.

9.1.7.3 Institutional Controls

For the capped landfills, maintenance/repair and monitoring program will be required after capping and closing the landfills. A maintenance/repair program will be established to maintain the caps and prolong their life span. The monitoring program will be established to test and monitor if any contaminants are migrating from the landfills into the groundwater beneath and around the landfills. This program will be implemented in accordance with the IEPA requirements for closed landfills. The monitoring and maintenance programs will be reviewed and approved by the USEPA and IEPA.

Legal restrictions on uncontrolled excavation and land use to minimize human contact with landfill materials will be specified in the deed for the landfills that will be capped on-site (L3, M11, and M13). In addition, site M9, which will be excavated and disposed, and site M1, will also have some legal and excavation restrictions because it falls within the boundaries of a GMZ. Excavation that may cause plume migration or any other groundwater disturbance, especially well installation, will be restricted at these sites. These restrictions will be in the deed or leasing agreements.

9.1.7.4 Remedial Time and Cost

The estimated time required for remediating of the landfill in SRU6are:

- Three to four years for capping landfills in sites L3. M11, and M13 based on construction materials available from other cleanup actions at JOAAP.
- One year for Excavation and Disposal of landfills in sites L4, M1, and M9.

Upon completion of the excavation and disposal of the landfills in sites L4, M1, and M9, no further cleanup action will be required for these sites. Upon completion of Capping the landfills in sites L3, M11, and M13, a long-term monitoring program will be implemented in accordance with the IEPA requirements for closed landfills.

The total present worth of capital and annual costs of the Capping L3, M11, and M13 landfills based on FS volumes is $19,900,000. The present worth of capital and annual costs of the Excavation and Disposal of the L4, M1, and M9 based on FS volumes is $12,100,000.

<u>9.1.8 SRU7: Sulfur ö Removal and Recycle or Disposal</u>

Described below are the remediation actions under the Removal and Recycle or Disposal remedy and the treatment time and cost associated with this remedy. Some of the remedial actions were described in the common action section above and are only listed below. The removal of sulfur is not regulated under CERCLA.

The Excavation and Disposal remedy will include:

- Soil Excavation, Transportation, and Confirmatory Sampling (*Section 9.1.1.2*);
- Backfilling, Regrading, and Revegetating Excavated Areas (*Section 9.1.1.4*);
- Sulfur Recycle or Disposal; and
- Institutional Controls.

Remedial actions at all sites for SRU7 are considered final.

9.1.8.1 Sulfur Recycle or Disposal

Approximately 7,500 cubic yards of raw sulfur will be excavated and hauled for recycling or disposal. The raw sulfur found on the surface and upper layers of soil in study areas M8and M12 will be scraped and separated from the soils at the site. The sulfur may have some commercial salvage value.. The U.S. Army is investigating the possibility of reuse of sulfur. However, if it is found that this sulfur has no commercial value, it will be disposed at the future proposed WCLF or at an existing permitted facility as a non-hazardous waste.

9.1.8.2 Institutional Controls

Legal restrictions on uncontrolled excavation and land use to minimize human contact with contaminated soil/sediment will be specified in the deed for sites M8 and M12 because these sites fall within a GMZ. Although the GMZ will be established mainly for explosives and not for sulfur, institutional controls will still apply to these two sites. Excavation that may cause plume migration or any other groundwater disturbance, especially well installation,will be restricted at these sites. These restrictions will be in the deed or leasing agreements.

9.1.8.3 Remedial Time and Cost

The estimated time required for raw sulfur removal and disposal associated with SRU7 is less than one year..

The total present worth of capital costs of the Excavation and Disposal of 7,500 cubic yards of sulfur is $200,000.

9.2 Groundwater Operable Unit

Remedial actions at all sites for the Groundwater Operable Unit are considered final.

9.2.1 Common Groundwater OU Actions

The limited action remedy for groundwater combines source removal of overlying contaminated soils; institutional controls to prevent exposure to potentially contaminated groundwater; and monitored natural attenuation to lower contaminant levels in groundwater to below the RGs. Institutional controls are required because levels of some contaminants in groundwater exceed safe levels for human consumption, and may exceed those levels for several decades. One of the primary institutional control mechanisms is the establishment of Groundwater Management Zones surrounding each of the GRUs in accordance with Illinois Code 35 IAC 620.250. Another primarycomponent of the institutional controls is the imposition of site-specific deed and zoning restrictions. This selected remedy also includes contingency plans should the remedy prove ineffective. Following is a description of the common actions that are included in the selected remedy.

9.2.1.1 Groundwater Management Zone (GMZ)

GMZs are three-dimensional regions containing groundwater being managed to mitigate impairment in accordance with Illinois Code 35 IAC 620.250. The GMZs will comprise both the glacial drift and shallow bedrock aquifers. The GMZs will be surveyed as depicted in Figure 4. Any future modification of the GMZ boundaries will be by mutual agreement between the Army, USEPA and IEPA.

Groundwater monitoring wells located inside and/or at the borders of each GMZs will monitor the contaminated plumes. If groundwater migrating outside the GMZs is contaminated in excess of the RGs, then appropriate contingency actions will be taken.

Deed restrictions, as described in Section 9.2.1.2. address limitations on actions and on the use of groundwater within of the GMZs.

GMZs, shown in Figure 4, were established around areas where either Illinois' Class I or Class II water quality standards are not met. The majority of GMZs at JOAAP surround areas that do not meet the less stringent Class II standards. Only one GMZ – that surrounding Site M3, where benzene was detected in monitoring well MW233 in 1991 - has been established for an area that meets Class II standards but does not meet Class I standards.

9.2.1.2 Institutional Controls – Deed Restrictions on Groundwater Use

Deed restrictions have been developed or are being developed separately from this Record of Decision by the Army, USEPA, IEPA and the future land users - the Joliet Arsenal Development Authority (JADA), and the US Department of Agriculture (USDA). These deed restrictions cover limited areas of the lands to be used for industrial parks and for the Midewin Tallgrass Prairie.

These deed restrictions will run with the land until removed by mutual agreement of the Army, USEPA, IEPA and the current landowner. The deed restrictions will be recorded with the Will County Recorder (302 N. Chicago Street, Joliet, IL 60432). Section 120(h)(3) of CERCLA defines precise requirements for the contents of deeds for property to be transferred from the Federal government, in which, hazardous or toxic substances were stored for greater than a year, or were released into the environment. Specifically, it states that: "in the case of any real property owned by the United States on which any hazardous substance was stored for one year or more, known to have been released, or disposed, each deed entered into for the transfer of such property by the United States to any other person or entity shall contain—(A) to the extent such information is available on the basis of a completesearch of agency files—(i) a notice of the type and quantity of such hazardous substances, (ii) notice of the time at which such storage, release, or disposal took place, and (iii) a description of the remedial action taken, if any, and (B) a covenant warranting that—(i) all remedial action necessary to protect human health and the environment with respect to any such substance remaining on the property has been taken before the date of such transfer, and (ii) any additional remedial action found to be necessary after the date of such transfer shall be conducted by the United States; and (C) a clause granting the United States access to the property in any case in which remedial action or corrective action is found to be necessary after the date of such transfer.

The intent of these deed restrictions is to protect human health and the environment by: (i) preventing the exacerbation of contaminated groundwater aquifers; (ii) maintaining the integrity of the confining layers that surround contaminated groundwater aquifers to prevent drainage or other migration thereof from their current positions; and (iii) preventing the creation of pathways of exposure to human or ecological receptors from contaminated groundwater aquifers. The deed restrictions to be placed on the land will include but are not limited to:

- Land in the areas designated for industrial park can not be used for residential use. Land designated for the USDA can not be used for industrial or residential use,
- Restrictions on the use or disturbance of groundwater in a way that could cause the migration of the contaminated groundwater plumes,
- Requirements to maintain the integrity of groundwater monitoring and wells,
- Requirement that groundwater above the Maquoketa shale not be used for potable water supply.

Section 9.3 addresses related institutional controls involving notification, enforcement, access and non-detrimental use. Section 9.1.1.6 addresses deed restrictions placed on lands and soils.

9.2.1.3 Site Inspections

The Army will perform periodic inspections at the same time as the sampling effort to examine the condition of wells and to verify compliance with deed restrictions.

9.2.1.4 Groundwater Monitoring

Natural Attenuation Models will be developed for the three GRUs during the remedial design phase of the project to refine predictions on the rate of contaminant reduction and the ultimate time required for contaminant levels in groundwater to be lowered to below the RGs. An integral component of the Natural Attenuation Models will be an extensive groundwater monitoring program. It is anticipated that two to three comprehensive rounds of groundwater sampling and analyses will be required to establish and calibrate the model at each GRU, and that routine periodic sampling and chemical analysis of groundwater will be required while contaminant levels in groundwater exceed the RGs. The exact number of wells to be sampled, the frequency, duration and list of analytical parameters will be established during the remedial design. All details of the sampling, chemical and statistical analyses employed in the groundwater monitoring program will be mutually agreed upon by the Army, the USEPA and the IEPA. At a minimum, all results will be reviewed and evaluated every five years by the Army, USEPA and IEPA to assure satisfactory progress of the selected Limited Action remedy toward achievement of the RGs.

The groundwater monitoring program will be developed by the Army during the Remedial Design phase. It will be reviewed and approved by USEPA and IEPA prior to implementation.

Monitoring wells will be located to assure no groundwater exits the GMZ at concentrations above the RGs. Although precise details remain to be defined in design of the natural attenuation model and remedy, the monitoring will include an array of wells situated in three distinct general types of areas. The first area will be within the plume or area of contamination. These wells will be used to assess and monitor the rate of reduction of contaminants within each plume, and serve as the primary basis for evaluating the effectiveness of the limited action remedy. Surface water will be monitored to track exfiltration at locations where there is a critical groundwater to surface water interface. Surface water downstream of these locations will be monitored to assure compliance with the surface water quality criteria as shown in Table 10.1.

The second area of well placements will be at locations downgradient of a plume and between the plume and the GMZ boundary. The purpose of these wells will be to provide early warning to prevent groundwater with concentrations of contaminants above the RGs from reaching the compliance point. These wells will also add information regarding the mechanisms driving the natural attenuation process and will help serve as a basis for determining the effectiveness of the natural attenuation.

The third area of well placements will be around the perimeter of the GMZ. The wells will serve as compliance points and will be preferentially located down gradient of the plume. The purpose of these wells is to assure compliance with the conditional requirements of a groundwater management zone.

Groundwater monitoring will continue until contaminant concentrations in groundwater are reduced to meet the RGs. The monitoring plan will utilize existing groundwater monitoring wells to the maximum extent practicable, and new monitoring wells will be located as needed to calibrate and operate the natural attenuation model. Changes proposed for the monitoring program will require concurrence from both the USEPA and the IEPA.

9.2.1.5 Natural Attenuation

The concept of natural attenuation is the basis for adopting a passive remediation approach to impacted sites. It has emerged as a feasible remediation strategy due to the recognition that intrinsic biological, physical/chemical processes such as biological degradation, sorption, dispersion, and dilution, are constantly in operation. Under specific conditions, contaminants left in place in soil or groundwater undergo natural attenuation that reduces the contaminant concentrations to acceptable levels. Benzene and toluene are known to be readily biodegradable by indigenous microorganisms. There are numerous successful studies on remediating petroleum-contaminated sites (where these two compounds are the predominant components of the impacted media) using in-situ biodegradation technology. Field application of biodegradation of explosives has been shown to be possible based on several laboratory studies.

Published literature indicates that explosives can be effectively biodegraded anaerobically. Under anaerobic conditions, explosives such as TNT, are shown to be initially reduced to monoaminonitrotoluenes and subsequently to diaminonitrotoluenes. These diaminonitrotoluenes are further biologically transformed to organic acid end products, or become irreversibly bound to clays or humic materials in soils.

9.2.1.6 Contingency Plan

GMZs are established in accordance with 35 IL Adm. Code 620 under the requirement that corrective actions are implemented to clean up the groundwater. The Army is initially implementing the required corrective actions in two ways at JOAAP. First, the Army will undertake source removal with the planned remediation of contaminated soils that have contributed to the plumes. Second, the Army will utilize the limited action remedy of monitored natural attenuation to degrade the contaminant levels in the plumes to RG levels or below

Within fifteen (15) months of signature of the ROD, the Army shall develop a scientific and defensible groundwater model of contaminant reduction assuming implementation of the limited action remedy. The model will predict contaminant reduction for the available contingency options.

Due to predicted length of time, (20-340 years) for the limited action remedies to lower groundwater contaminant levels to below the RGs in the three GRUs, a plan is needed to assure the selected remedy will ultimately mitigate risk to human health or the environment. Significant effort will be made during the remedial design to develop a natural attenuation model to refine the prediction of the rate of degradation and more precisely determine the ultimate duration of the limited action remedy for groundwater. No later than five (5) years after completion of source removal, the Army shall deliver to USEPA and IEPA a report summarizing the efforts it has made to refine its prediction of the rate of degradation and more precisely determine the ultimate duration of the limited action remedy for groundwater. That report will present the specific information, data, and analysis needed to describe the effectiveness of monitored natural attenuation in reducing contaminant concentrations. The information provided in the report will include a description of the status of the deed restrictions, GMZs, monitoring program implementation, and groundwater modeling. It will also provide the analytical parameters and trends observed in the contamination found in each GMZ in accordance with the framework specified in the groundwater monitoring plan. The Army shall submit a similar report to the USEPA and IEPA every five (5) years after the submission of the first report. All reports shall include a description of the effectiveness of monitored natural attenuation in reducing contaminant concentrations in the GRUs since the submission of the previous report and since the date of execution of the ROD.

This initial report will also include a scientific and defensible review of the impact which available contingency options would have on the limited action remedy time frames. If the Army, USEPA and

IEPA determine that the limited action remedy time frames are unacceptable, alternative remedial actions will be developed and implemented in accordance with the NCP. The USEPA and IEPA reserve the right to require the Army to review available contingency options at any time during the remediation process.

Until RGs are met, the Army will evaluate phytoremediation and other emerging technologies that are applicable to the degradation of explosives in groundwater as a potential means of accelerating or enhancing the natural attenuation remedy.

9.2.2 GRU1: Explosives in Groundwater -LAP Area ö Limited Action

Described below are the remediation actions under the Limited Action remedy selected for this GRU. Most of the remedial actions were described in general terms in Section 9.2.1. Following is a detailed description of the remedy specific to GRU1. The Limited Action includes:

- Establishment of GMZs;
- Source Removal (see relevant SRU sections);
- Institutional Controls -- Deed Restrictions on Groundwater Use (*Section 9.2.1.2*);
- Site Inspections (*Section 9.2.1.3*);
- Groundwater and Surface Monitoring;
- Natural Attenuation; and
- Contingency Plan Implementation, if necessary (*Section 9.2.1.6*).

9.2.2.1 Establishment of GMZs

GMZs will be established under this alternative at each of the four sites included in GRU1. The area of the different GMZs is illustrated in Figure 4. The horizontal extent of the GMZs is shown on Figure 4. The vertical extent of the GMZs is between 100 and 200 feet – from the ground surface to the bottom of the Silurian Dolomite Aquifer (also known as the Shallow Bedrock Aquifer). Although groundwater contamination has only been identified in the glacial till at Site L14, because the glacial till is hydraulically connected with the Silurian Dolomite, the GMZ at this site also extends to the base of the dolomite.

9.2.2.2 Groundwater Monitoring

A groundwater monitoring program will be established for GRU1 plumes. This program is intended to provide the details necessary to more accurately predict the rate of natural attenuation, and to evaluate the success of this alternative. All groundwater samples are assumed to be collected semi-annually from existing wells and proposed wells. All samples will be analyzed for explosives. Surface water samples will be collected in accordance with the NPDES permit, and to comply with the Illinois Water Quality Standards as listed in Table 10-1 of this ROD. No sediment sampling is proposed because the RI determined that sediments in Prairie Creek were not contaminated.

The first round of groundwater and surface water sampling and analysis will include the additional parameters: dissolved oxygen, redox potential, pH and alkalinity, electron receptors (dissolved nitrate, iron, sulfate, and carbon dioxide), inorganic nutrients(ammonium, total phosphate, sulfate, and nitrate), temperature and total organic carbon. These data will be used to evaluate whether biological mechanisms are a significant factor in the degradation of explosives.

Data collected during the long-term monitoring period will be compiled, reviewed, and reevaluated every 5 years in accordance with 35 IAC 620.250. When it is determined by the Army and approved by USEPA and IEPA that the contaminant concentrations have reached the RGs, or it is determined that the remaining contaminant concentrations do not pose a risk to human health or the environment, the monitoring program can be concluded. At that time, the Army will document to IEPA and USEPA the completion of the remedial action in accordance with 35 IAC 620.250(c), and the GMZ will expire.

Monitoring is assumed to continue for at least 30 years at Sites L1, L3, and L14; and for 20 years at Site L2. The length of time for monitoring is calculated based on assumptionsof affected area and estimated groundwater velocities. Groundwater data and modeling will be used to more accurately predict duration of the monitoring program. The actual frequency, duration, and analytical parameters may change with approval of the USEPA and IEPA, depending on the long-term results of monitoring. Each monitoring program should be evaluated every 5 years to ensure that it meets the data needs and program objectives.

9.2.2.3 Natural Attenuation

Natural attenuation at the GRU1 sites will involve the use of natural attenuation processes to reduce explosives concentration to the RGs. These processes include a wide variety of physical, chemical, or biological processes that act without human intervention and may include dispersion, dilution, adsorption, biodegradation, and chemical or biological stabilization or destruction. The actual processes that occur at each site will vary based on the physical, chemical, and biological characteristics of the soil, groundwater, and surface site conditions.

At Sites L1 and L2, there is some evidence to suggest that biodegradation of explosives may be occurring via phytoremediation in the wetlands area where groundwater is discharged to Prairie Creek, and via Treemediation ™ as groundwater passes through the root zone of wooded areas. These processes have been effective for explosives (phytoremediation) and other contaminants (Treemediation™), and a detailed study of the exact mechanisms occurring at Site L1 is being conducted by the U.S. Army and USEPA. At Sites L3 and L14, biological processes are expected to be less significant because of the absence of trees and wetlands. Physical and chemical attenuation processes are likely providing the predominant attenuation mechanisms at these sites. Source removal will decrease the potential for groundwater quality degradation, and will enhance the natural attenuation process. Should the site studies of phytoremediation within the plume area at Site L1 show promise, this technology may be implemented to enhance the natural attenuation process.

9.2.2.4 Remedial Time and Cost

The estimated time required for completion of the Limited Action remedy for GRU1 assumption that the plumes will flushed 10 times to achieve RGs. The estimated remediation times are 20 years for Site L2, 50 years for Site L3, 80 years for Site L14, and 340 years for Site L1. Recent data gathered as part of a study of natural attenuation of explosives being conducted at Site L1 indicates that these estimates may be overly conservative and that the actual time required may be two to four order of magnitude less. The time frame estimates will be adjusted as part of the monitoring program and modeling effort.. The estimated net present worth cost of the Limited Action remedy for GRU1 is $530,000.

9.2.3 GRU2: Explosives and Other Contaminants in Groundwater -MFG Area ö Limited Action

Described below are the remediation actions under the Limited Action remedy selected for this GRU. Most of the remedial actions were described in general terms in Section 9.2.1. Following is a detailed description of the remedy specific to GRU2. The Limited Action includes:

- Establishment of GMZs;
- Source Removal (see relevant SRU sections);
- Institutional Controls -- Deed Restrictions on Groundwater Use (*Section 9.2.1.2*);
- Site Inspections (*Section 9.2.1.3*);

- Groundwater Monitoring;
- Natural Attenuation (*Section 9.2.1.5*); and
- Contingency Plan Implementation, if necessary (*Section 9.2.1.6*).

9.2.3.1 Establishment of GMZs

Two GMZs will be established in GRU2. One is associated with the explosives and metals plume under site M1 (Southern Ash Pile), and the other with explosives plumes in the northern part of the manufacturing area. The horizontal extent of these GMZs is shown on Figure 4. The GMZ extends to the bottom of the Silurian Dolomite Aquifer (also known as the Shallow Bedrock Aquifer), a vertical distance of from 100 to 200 feet below ground surface

9.2.3.2 Groundwater Monitoring

The objective of the groundwater monitoring program is to detennine the rate of natural attenuation and to evaluate the effectiveness of the remedy. During the groundwater monitoring program, groundwater quality data will be collected that will confirm the absence of off-site migration or vertical groundwater migration into deeper formations. The groundwater data will also be used to evaluate temporal changes in constituent concentrations.

The GMZ encompassing sites M5, M6, M7, M8, and M13 is approximately 575 acres and extends vertically from the ground surface to the bottom of the Silurian Dolomite. The Army will develop, with USEPA and IEPA approval, the long-term groundwater monitoring program during the remedial design phase that will document at a minimum: number of wells, location of wells, and the chemicals of concern to be monitored. These wells will be sampled and analyzed for explosives, metals and VOCs semi-annually throughout the duration of the groundwater monitoring program. In addition, a well pair, one overburden and one shallow bedrock, will be installed downgradient of Explosive and PCE Plume (see Figure 4). During the Remedial Design, it may be necessary to install additional wells to complete the groundwater monitoring program. These new wells will be sampled and analyzed for explosives, metals and VOCs at the same frequency. These wells will be used to monitor natural attenuatton. Groundwater elevations will also be measured during each sampling event to determined hydraulic gradient.

The GMZ in M1 is approximately 61 acres and extends vertically from the ground surface to the bottom of the Silurian Dolomite. The Army will develop, with USEPA and IEPA approval, a groundwater monitoring program during the remedial design phase that will document at a minimum: number of wells, location of wells, and the chemicals of concern to be monitored. These wells will be sampled and analyzed for explosives and metals semi-annually for the first 5 years and annually for the remainder of the monitoring program. MW107 and MW231 will be sampled and analyzed for metals at the same frequency. In addition, a well pair, one overburden and one shallow bedrock, will be installed downgradient of the M1 Plume (see Figure 4). These new wells will be sampled and analyzed for explosives and metals at the same frequency. Data collected from these wells will be used to monitor and evaluate natural attenuation. Groundwater elevations will also be measured during each sampling event for plume migration information.

Data collected during the monitoring period will be compiled and reviewed every 5 years. When it is determined by the Army and approved by USEPA and IEPA that the contaminant concentrations have reached the RGs, or that the remaining constituent concentrations will not pose any adverse effect on human health and the environment, the monitoring will be concluded. A remedial action closure report documenting attainment of RGs will be submitted to the USEPA and IEPA for review and approval. This document will describe baseline contaminant levels, target remediation goals, trends in contaminant concentration, and the achievement of the remediation goals. Once the RGs have been reached, the Army will document to IEPA and USEPA the completion of the remedial action in accordance with 35 IAC 620.250(c), and the Limited Action remedy will expire.

9.2.3.3 Remedial Time and Cost

The estimated time for completion of the Limited Action remedy for GRU2 is 50 years. Recent data gathered as part of a natural attenuation study at Site L1 indicate that the time required to achieve RGs may be less than estimated. Monitoring data and modeling efforts conducted as part of this alternative will be used to refine the treatment time estimate. The estimated net present worth cost of the Limited Action remedy is $3,300,000.

9.2.4 GRU3: Volatile Organic Compounds (VOCs) in Groundwater -MFG Area ö Limited Action

Described below are the remediation actions under the Limited Action remedy selected for this GRU. Most of the remedial actions were described in general terms in Section 9.2.1. Following is a detailed description of the remedy specific to GRU3. The Limited Action will include:

- Establishment of GMZs;
- Source Removal (see relevant SRU sections);
- Institutional Controls -- Deed Restrictions on Groundwater Use (*Section 9.2.1.2*);
- Site Inspections (*Section 9.2.1.3*);
- Groundwater Monitoring;
- Natural Attenuation (*Section 9.2.1.5*); and
- Contingency Plan Implementation, if necessary (*Section 9.2.1.6*).

9.2.4.1 Establishment of GMZs

With USEPA and IEPA approval, the Army will establish two GMZs: one in the Western Toluene Tank Farm and the other in the Central Toluene Farm. The area of the GMZs in M10 is approximately 5 acres each and is a part of the GMZ that will be established for GRU3 (Figure 4). The horizontal extent of the GMZs is shown on Figure 4. The vertical extent of the GMZs is 100 to 200 feet below ground surface to the bottom of the Silurian Dolomite Aquifer (also known as the Shallow Bedrock Aquifer).

A special case GMZ, designated as GMZ I because of exceedance of Class I water quality standards has been established around Site M3 (Figure 4). This will remain until the Army, USEPA and IEPA have evidence that the benzene contamination detected in MW33 has degraded below the Class I standard (5 µg/L).

9.2.4.2 Groundwater Monitoring

The long-term groundwater monitoring program will be established during the remedial design phase and will document at a minimum: number of wells, location of wells, and the chemicals of concern to be monitored. These wells will be analyzed semi-annually for BTEX throughout the duration of the groundwater monitoring program. In addition, a well pair, one overburden and one shallow bedrock, will be installed in the Central Toluene Tank Farm to monitor the migration of contaminated groundwater. This well pair will also be monitored for BTEX concentrations at the same frequency. These wells will monitor plume migration. During Remedial Design, it may be necessary to install additional wells to complete the monitoring program. Existing wells at M3 will be sampled for VOCs.

Data collected during the monitoring period will be compiled and reviewed every 5 years from estimated 50 year period until the RGs are reached. When it is determined by the Army and approved by the USEPA and IEPA that the contaminant concentration have reached the RGs, or that the remaining constituent concentrations will not pose any adverse effect on human health and the environment, the monitoring will be concluded. The Army will document the completion of the remedial action in accordance with 35 IAC 620.250(c), and the GMZ will expire.

9.2.4.3 Remedial Time and Cost

The estimated time for completion of the Limited Action remedy for GRU3 is 50 years. Recent data gathered as part of a natural attenuation study of explosives contaminated groundwater at Site L1 indicate that the time required to achieve RGs may be less than estimated. Monitoring data and modeling efforts conducted as part of this alternative will be used to refine the treatment time estimate. The estimated net present worth cost of the Limited Action remedy is $700,000.

9.3 Institutional Controls

Institutional controls are intended to protect human health and the environment. They include the controls described below as well as deed restrictions, as described in Sections 9.1.1.6 and 9.2.1.2.

9.3.1 Notifications to Recorder's Office

The Army will file with the Recorder's Office or Registry Office or other appropriate office, within 90 days of approval of the ROD, a USEPA approved notice to all successors in title that:

(i) the property is part of the JOAAP Site,
(ii) the Army, USEPA and IEPA selected remedies for the JOAAP Site in October 1998, as specified within this Record of Decision,
(iii) the Army entered into a Federal Facility Agreement (FFA) with the USEPA Region V and the State of Illinois on June 9, 1989 requiring implementation of the remedy by the Army. This FFA is under CERCLA Section 120, in the matter of: "The U.S. Department of Defense, The Army, Joliet Army Ammunition Plant, Elwood, Illinois."
(iv) Copies of the FFA and ROD are located at the Joliet and Wilmington Public libraries and also at the USEPA Region 5 Headquarters.

The Army will provide to USEPA a copy of this notice within 30 days of its filing.

9.3.2 Notifications to Land Owners of Access Easements and Restrictive Easements

At least 30 days prior to any transfer of real estate located within JOAAP site, the Grantor shall provide the Grantee with a copy of the FFA and the ROD. Any deed, lease, license, permit, or casement from the Army shall contain language that the Grantee received copies of the FFA and the ROD at least 30 days prior to the conveyance of the respective interest in the property located within the JOAAP site. At least 30 days prior to such conveyance or transfer, the Army shall give written notice to USEPA and the IEPA of the proposed conveyance or transfer including the name and address of the Grantee. The deeds shall be properly recorded in the recorder's office and copies submitted to USEPA as discussed in Section 9.3.1.

9.3.3 Notifications to Will County of Restricted Use of Water

The Army will notify the Will County Health Department, Environmental Division (501 Ella Avenue, Joliet, IL 60433) that:

- the groundwater contained in the glacial till and shallow bedrock does not meet Class II (industrial) water quality standards for all GMZs except that at Site M3
- the groundwater contained in the glacial till and shallow bedrock below Site M3 does not meet Class I (potable) water quality standards

- the water supply wells placed anywhere within the JOAAP should be tested at least for the contaminants of concern at JOAAP before use for whatever purpose.

9.3.4 Review Authority of the USEPA and IEPA

USEPA and IEPA retain the right to review and approve the environmentaldeed restriction language in the Army's transfer of JOAAP land.

9.3.5 Continuing Responsibilities of the Army

In the event of any conveyance, the Army's obligations under this ROD and the FFA, including, but not limited to, its obligation to provide or secure access, pursuant to Section XXI of the FFA, or institutional controls, as well as to abide by such institutional controls, shall continue to be met by the Army. In no event shall the conveyance of a property interest release or otherwiseaffect the liability of the Army to comply with all provisions of the FFA or the ROD, absent the prior written consent of USEPA, Region 5.

9.3.6 Non-Detrimental Use of the Property by the Army

Commencing on the date the ROD is signed, the Armyshall refrain from using the JOAAP site, or such other property, in any manner that would interfere with or adversely affect the integrity or protectiveness of the remedial measures to be implemented pursuant to this ROD. The restrictions on the use of the property are as outlined in Sections 9.1.1.6 and 9.2.1.2 and as specified in the deed restrictions negotiated separately from this document.

9.3.7 Easement

The Army shall retain an easement, running with the land, that grants a right of access for the Army, the USEPA and the IEPA for the purpose of conducting any activity related to this ROD and the FFA including, but not limited to the following activities:

a) Monitoring the work;
b) Verifying any data or information submitted to the United States or the State;
c) Conducting investigations relating to contamination at or near the Site;
d) Obtaining samples;
e) Assessing the need for, planning, or implementing additionalresponse actions at or near the Site;
f) Implementing the work pursuant to the conditions set forth in the FFA and the ROD;
g) Inspecting and copying records, operating logs, contracts, or other documents maintained or generated by the Army or their agents, consistent with the FFA's section on Access;
h) Assessing the Army's compliance with the FFA and the ROD; and
i) Determining whether the Site or other property subject to this ROD is being used in a manner that is prohibited or restricted or that may need to be prohibited or restricted by, or pursuant to, the FFA or the ROD.

The Army shall retain this easement and this "retained" easement shall be clearly identified in all documents pertaining to the property that is part of the JOAAP sites (this includes property designated for no further action), including the Findings of Suitability of Transfer (FOSTs), contracts of sale or for the transference of the property, and deeds used to transfer the property.

9.3.8 Enforcement of Restrictions

The Army shall retain the right to enforce the land/water use restrictions (Deed Restrictions) or other restrictions that are placed on the JOAAP sites. This right shall be stated in all documents, including deeds used to transfer any of the property that is the part of the JOAAP sites (this includes property designated for no further action), FOSTs, contracts of sale or for the transference of the property, and leases concerning the property.

The deeds used to transfer any of the property from the JOAAP sites (including propertydesignated for no further action, as appropriate) shall provide for the enforcement by the United States of the land/water use restrictions listed in the ROD and/or the FOSTs, or other restrictions the USEPA, IEPA and Army determine are necessary to implement, ensure noninterference with, or ensure protectiveness of the remedial measures to be performed pursuant to the ROD and FFA.

The Army shall be entitled to enforce the terms of the Deed Restrictions or other restrictions by resort to specific performance or legal process against all Grantees of the property that is part of the JOAAP sites (including the property designated for no further action) and their successors and assigns. All reasonable costs and expenses of the Army, including, but not limited to attorney's fees, incurred in any such enforcement action shall be borne by the Grantee or its successor in interest to the property.

[END OF SECTION]

10 STATUTORY DETERMINATIONS

Executive Order 12580 (January 23, 1987) delegates the authority for carrying out the requirements of CERCLA Sections 104(a), (b), and (c)(4) (42 U.S.C. 9604 (a), (b), (c)(4) and 121 (42 U.S.C. 9621) to the Department of Defense, to be exercised consistent with Section 120 (42 U.S.C. 9620) of the Act. Therefore, under its legal authorities, the Army's primary responsibilityis to undertake remedial actions that achieve adequate protection of human health and the environment.

In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences. These requirements specify that when complete, the final remedial actions must comply with applicable or relevant and appropriate environmental standards established under Federal and State environmental laws unless a statutory waiver is justified. The final remedies also must be cost effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduce the toxicity, mobility, or volume of hazardous substances as their principal element. The following sections discuss how the selected remedies are consistent with these statutory requirements.

10.1 Protection to Human Health and the Environment

10.1.1 Soil OU

All the selected remedies, with the exception of capping, will remove or treat the contaminated soil from the sites and subareas. The removed soil will either be treated or disposed of in permitted facilities. The presumptive remedy was selected for three of the landfills in SRU6; these landfills will be capped. The final remedies selected for the soil OU will be protective to current and future users of these sites, and both final and interim remedies will prevent or minimize direct exposure of groundwater to the contaminated soil and minimize the leaching of contaminants from soil to groundwater. The selected final remedies will reduce the carcinogenic risks to fall within the USEPA's acceptable risk range of 10^{-4} to 10^{-6}; in addition, the Hazard Index for non-carcinogens will be reduced to less than one. There are no short-term threats associated with the selected remedies that can not be easily controlled, and there are no adverse cross-media impacts. The cross-media impacts are actually positive in nature because by treating the soil, in most cases the source of groundwater contamination is removed.

10.1.2 Groundwater OU

The selected remedy for the three GRUs is Limited Action. This remedy by itself will not include active remedial actions; however, combined with contaminated soil removal and treatment, the Limited Action remedy will reduce and control potential risk to human health and the environment. After coupling the Limited Action remedy with soil removal, treatment, or disposal and natural attenuation, it is expected that groundwater contamination will decrease to levels below the risk-based RGs. This remedy will reduce the carcinogenic risks to fall within the USEPA's acceptable risk range of 10^{-4} to 10^{-6}. In addition, the Hazard Index for non-carcinogens will be reduced to less than one. No unacceptable short-term risk or cross-media adverse impacts will be caused by implementation of the selected remedy.

10.2 Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) and To-Be-Considered (TBC) Guidance

10.2.1 Soils Operable Unit (OU)

The selected remedies will comply with all Federal and any more stringent State ARARs. The major ARARs that will be attained by the components of the selected remedies are list below. The list of ARARs below is intended to be comprehensive; additional ARARs may be identified during remedial design and remedial action with USEPA and IEPA approval.

10.2.1.1 Chemical-specific ARARs and TBC Guidance for Soils and Sediment

ARARs and TBCs necessary for protection must be attained for hazardous substances, pollutants, or contaminants remaining on-site at the completion of the final remedial actions. There are no federal laws providing maximum allowable residual levels for the chemicals of concern in shallow soils. Likewise, for sites listed on the National Priority List, such as JOAAP [40 C.F.R. Part 300 (1997)], the State of Illinois has no promulgated enforceable standards for chemicals of concern in soil. Therefore, the following approaches were used to derive remediation goals for the final COCs (as in Table 6-2):

- *Explosives, Metals, PAHs, a-Chlordane, Phosphate*
  Industrial scenario - USEPA Region 3 Risk-Based Concentrations (RBCS). **TBC guidance** for remediation of soil and sediment at JOAAP.

- PCBs
  Cleanup standards established under USEPA's PCB Spill Cleanup Policy (40 C.F.R. 761.120(1997) for nonrestricted access areas is 10 mg/kg; for all surface soil is 1 mg/kg (upper 10 inches of soil) - **TBC guidance** values agreed upon for the PCBs in the soil at SRU4 by the IEPA and USEPA Region 5.

- *Lead*
  Remediation goal for industrial scenario is 1,000 mg/kg - **TBC guidance** value agreed upon by the IEPA and USEPA Region 5, taking into consideration frequency of exposure and USEPA's historic approaches.

- *Illinois Surface Water Quality Standards*
  Table 10.1 shows surface water and soil standards that will be applied to within the Soils OU for the chemicals of concern at JOAAP. The Illinois Water Quality Standards will be **applicable** for waters coming off of SRUs. These may either be applied at compliance points as established for the NPDES permit at JOAAP or at compliance points as agreed by the Army, USEPA and IEPA during the remedial design phase.

- *RCRA Listed, Characteristic and Special Wastes*
  In order to address the relationship between RCRA and CERCLA cleanup/remediation requirements, the Army, USEPA and IEPA have agreed to the following:

  > If a media contaminated with a listed or characteristic hazardous waste is treated to the remediation goals specified in the ROD for the facility, the LDRs specified in 35 IAC 728, and no longer exhibits any characteristic of a hazardous waste, the media would not contain a RCRA listed or characteristic hazardous waste. However, unless the treatment method actually destroyed or removed the contaminants of concern from the media, the treated media might still

be considered a special waste and, therefore, subject to the special waste regulations at 35 IAC 808 through 815. (letter from C. Grigalauski, IEPA, to A. Holz, JOAAP, dated July 24, 1998).

Special wastes are defined under the Illinois Environmental Protection Act as, "any industrial process waste, pollution control waste or hazardouswaste except as determined pursuant to Section 22.9 of [the] Act. Special waste also means potentially infection medical waste."

Special waste permits are required to transport special waste, including hazardous waste, that is generated and/or disposed of in Illinois. A permit is vehicle-specific and a copy of the approved permit must be carried in each permitted vehicle. Transporters carrying special wastethrough the state that is not generated nor disposed of in Illinois arenot required to have the Illinois special waste hauling permit, although the load must be accompanied by the proper manifest.

- *TCLP Limits*
  The RCRA TCLP (Toxicity Characteristic Leachate Procedure) limits will be used in addition to the RGs to test soils at JOAAP. The TCLP tests will, as necessary, be conducted on (a) soils left at a site, (b) soils to be treated, and (c) soils coming out of treatment. If treated soils fall TCLP, they must be either stabilized and disposed at a permitted RCRA Subtitle D landfill (WCLF) or disposed at a RCRA Subtitle C facility off-site. If pre-treatment TCLP tests indicate that the soils will fail TCLP even after treatment and the soils are not RCRA hazardous wastes based on explosives contamination, then the Army will dispose the soils at a RCRA Subtitle C facility directly without treatment. The Army at its option and with the approval of the USEPA and IEPA may also treat those soils that fail TCLP so that they may be disposed at WCLF or other landfill as appropriate.

Table 10.1: Water Quality Standards and TCLP Concentration Limits

Contaminant	Water Quality Standards (µg/L)	TCLP Extract Concentration Limits (mg/L)
Explosives		
1,3,5-TNB	15	NA
1,3-DNB	4	NA
2,4,6-TNP	700	NA
2,4,6-TNT	75	NA
2,4-DNT	330	0.13
2,6-DNT	150	NA
2-NT	62	NA
DNAP	400	NA
HMX	260	NA
NB	8,000	2.0
RDX	500	NA
Tetryl	NA	NA
Metals		
Aluminum	NA	NA
Antimony	610	NA
Arsenic	160	5
Barium	5,00	100
Beryllium	NA	NA
Cadmium	2.3	1
Chromium (+3)	440	5

Contaminant	Water Quality Standards (µg/L)	TCLP extract Concentration Limits (mg/L)
Chromium (+6)	11	5
Cobalt	NA	NA
Copper	26	NA
Iron	1,000	NA
Lead	64	5
Manganese	1.3	NA
Mercury	1,000	0.2
Nickel	1,000	NA
Silver	5	5
Selenium	20	5
Thallium	NA	NA
Vanadium	1,000	NA
Zinc		NA
Volatiles		
1,1,1-Trichloroethane	390	NA
1,1,2-Trichloroethane	NA	NA
1,1-Dichloroethane	2,000	NA
1,2-Dichloroethane	4,500	0.5
1,2-Dichloroethene	1,100	NA
Acetone	120,000	NA
Benzene	420	0.5
Chloroebenzene	79	100
Ethylbenzene	17	NA
Tetrachloroethene	150	0.7
Toluene	650	NA
Trichloroethene	NA	0.5
Xylenes	110	NA
Semivolatiles		
1,2-Dichlorobenzene	17	NA
1,3-Dichlorobenzene	200	NA
1,4-Dichlorobenzene	620	7.5
2-Chloronaphthalene	30	NA
2-Methylnaphthalene	12	NA
2-Methylphenol	370	NA
4-Methylphenol	120	NA
1,2,4-Trichlorobenzene	72	NA
Acenaphthene	62	NA
Acenaphthylene	NA	NA
Anthracene	35,000	NA
Benzo(a)anthracene	0.1	NA
Benzo(a)pyrene	0.1	NA
Benzo(g,h,I)perylene	NA	NA
Benzo(b)fluoranthene	0.1	NA
Benzo(k) fluoranthene	1	NA
Benzyl alcohol	80	NA

Contaminant	Water Quality Standards (µg/L)	TCLP extract Concentration Limits (mg/L)
Bis(2-ethylhedyl)phthalate	NA	NA
Butyl benzyl phthalate	23	NA
Chrysene	10	NA
Dibenz(a,h)anthracene	0.01	NA
Dibenzofuran	12	NA
Diethyl phthalate	NA	NA
Di-n-butyl phthalate	NA	NA
Di-n-octyl phthalate	NA	NA
Fluoranthene	120	NA
Fluorene	NA	NA
Hexachlorobenzene	4,500	0.13
Indeno[1,2,3-cd]pyrene	0.00025	NA
Naphthalene	68	NA
Phenanthrene	3.7	NA
Phenol	NA	NA
Pyrene	3,500	NA
Anions		
Nitrate/Nitrite	NA	NA
Phosphate	50	NA
Phosphorous	50	NA
Sulfate	500,000	NA
PCBs		
Chlordane	NA	0.03
DDD	NA	NA
DDE	NA	NA
DDT	0.00019	NA
Dieldrin	0.000045	NA
Endrin	0.033	0.02
Heptachlor	0.000068	0.008
Heptachlor epoxide	NA	0.008
Isodrin	0.1	NA
PCB 1254	0.00001	NA
PCB 1260	0.00001	NA
Organics-Special		
TPH	NA	NA

10.2.1.2 Action-Specific ARARs for Soils OU

10.2.1.2.1 ARARs for Specific Activities Common to all Soil Remediation Units (SRUs)

Fugitive dust emissions

For emissions associated with building demolition, soil extraction, soil preparation, composting, and transportation, the following requirements will be ARARs:

- 35 I11. Admin. Code 201.141, Prohibition of Air Pollution - **applicable** to actions that threaten or allow the discharge or emission of any contaminant into the environment which causes or tends to cause air pollution in the State of Illinois or which violates or prevents the attainment or maintenance of any applicable ambient air quality standard.
- 35 Ill. Admin. Code 212.301, Fugitive Particulate Matter - **applicable** if fugitive dust emissions are produced from the remedial activities conducted pursuant to each remedy. This section prohibits the emission of fugitive particulate matter from any process, including material handling or storage activity, that is visible by an observer looking generally toward the zenith at a point beyond the property line of the source.
- 35 I11. Admin. Code 212.314, Exception for Excess Wind Speed - **applicable** if wind speed is greater than 40.2 km/hr (25 mph).
- 35 Ill. Admin. Code 212.315, Covering for Vehicles - **applicable** if vehicles are utilized pursuant to any remedy to transport excavated soil to central treatment areas or off-site for disposal.

<u>Investigation-derived waste</u>

- USEPA OSWER Publication 9345.3-03FS (January 1992) - **TBC Guidance**, for IDW produced for confirmatory or other sampling procedures.

<u>Institutional controls</u>

- The following will be **applicable** to each soil remedy: 35 I11. Admin. Code 724.216, Survey Plat; and 40 C.F.R. §300.430(a)(1)(iii)(D).
- Substantive portions of 35 Ill. Adm. Code 742 Subpart J will be followed for institutional controls to be placed on the property (35 Ill. Adm. Code 742.1000) and for issuance of No Further Remediation Letters, Restrictive Covenants, Deed Restrictions and Negative Easements, and Local Ordinances. (35 I11. Admin. Code 742.1005, 742.1010, and 742.1015.)

<u>Storm water discharges</u>

- For storm water discharges from either composting or excavation activities, the substantive requirements of the Illinois NPDES permit program (35 I11. Admin. Code 309) will be **applicable**. For excavation activities, the substantive requirements of the Illinois general permit for Construction Site Activities (NPDES Permit No. ILR10) will be followed. For composting activities involving non-hazardous contaminated soil, the substantive requirements of the Illinois General NPDES Permit for Industrial Storm Water (NPDES Permit No. ILR00) will be followed. JOAAP currently has a valid NPDES permit and the JOAAP will comply with it.

<u>UXO/TNT</u>

If UXO is found, it will be screened, removed and stockpiled for either open burn/detonation on-site or off-site incineration at a permitted facility. Raw TNT may be transported off-site for disposal.

- For on-site Open Burning/Open Detonation of UXO, the substantive requirements set forth in the following sections will be **applicable** to open burn/open detonation activities during implementation of this remedial alternative: 35 I11. Admin. Code 724.701, Environmental Performance Standards; 35 I11. Admin. Code 724.702, Monitoring, Analysis, Inspection, Response, Reporting and Corrective Action; and 35 Ill. Admin. Code 724.703, Post-closure Care.

- If raw TNT is transported off-site for disposal and meets the definition of a hazardous waste or for off-site incineration of UXO, the following requirements will be **applicable**: 35 Ill. Admin. Code 722.111, Hazardous Waste Determination; 35 Ill. Admin. Code 722.112, USEPA Identification

Numbers; 35 Ill. Admin. Code 722.120, General Requirements; 35 Ill. Admin. Code 722.121, Acquisition of Manifests; 35 Ill. Admin. Code 722.122, Number of Copies; 35 Ill. Admin. Code 722.123, Use of the Manifest; 35 Ill. Admin. Code 722.130, Packaging; 35 Ill. Admin. Code 722.131, Labeling; 35 Ill. Admin. Code 722.132, Marking; 35 Ill. Admin. Code 722.133, Placarding; 35 Ill. Admin. Code 722.140, Record keeping; 35 Ill. Admin. Code 722.141, Annual Reporting; 35 Ill. Admin. Code 722.142, Exception Reporting; 35 Ill. Admin. Code 722.143, Additional Reporting; 35 Ill. Admin. Code 728.107, Waste Analysis and Record keeping; and 35 Ill. Admin. Code 728.109, Special Rules for Characteristic Wastes and Illinois Department of Transportation Regulations: 92 Ill. Admin. Code 171; 92 Ill. Admin. Code 172; 92 Ill. Admin. Code 173; and 92 Ill. Admin. Code 177.

In addition, theUXO/TNT will be classified as a special waste; therefore, the following special waste regulations relating to manifesting and transport will be **applicable**: 35 Ill. Admin. Code 808.121, Generator Obligations; 35 Ill. Admin. Code 808.240, Special Waste Classes; 35 Ill. Admin. Code 808.241, Default Classification of Special Wastes; 35 Ill. Admin. Code 808.242, Special Handling Waste; 35 Ill. Admin. Code 808.243, Wastes Categorized by Source; 35 Ill. Admin. Code 808.244, Wastes Categorized by Characteristics; 35 Ill. Admin. Code 808.245, Classification of Wastes; 35 Ill. Admin. Code 808 Subpart D, Request for Waste Classification; 35 Ill. Admin. Code 808 Subpart H, Categorical and Characteristic Wastes; and 35 Ill. Admin. Code 808 Appendix A, Assignment of Special Waste to Classes; and 35 Ill. Admin. Code 808 Appendix B, Toxicity Hazard; 35 Ill. Admin. Code 809 Subpart B, Special Waste Hauling Permits; Subpart C, Delivery and Acceptance; Subpart D, Vehicle Numbers and Symbols; Subpart E, Manifests, Records and Reporting; Subpart F, Duration of Permits... and; Subpart G, Emergency Contingencies for Spills.

<u>Wash water</u>

Wash water from trucks and the pressure wash operation will be containerized and either used as makeup water in the treatment process or containerized for off-site disposal.

- If wash water meets the definition of a hazardous waste, then the following requirements associated with containers will be **applicable** to this remedial alternative: 35 Ill. Admin. Code 722.134, Accumulation Time, 35 Ill. Admin. Code 724.271, Condition of Containers; 35 Ill. Admin. Code 724.272, Compatibility of Waste With Container; 35 Ill. Admin. Code 724.273, Management of Containers; 35 Ill. Admin. Code 724.275, Containment; and 35 Ill. Admin. Code 724.278, Closure.
- If the wash water meets the definition of a hazardous waste and is transported off-site for disposal, then the following requirements will be **applicable** to this remedial alternative: 35 Ill. Admin. Code 722.111, Hazardous Waste Determination; 35 Ill. Admin. Code 722.112, USEPA Identification Numbers; 35 Ill. Admin. Code 722.120, General Requirements; 35 Ill. Admin. Code 722.121, Acquisition of Manifests; 35 Ill. Admin. Code 722.122, Number of Copies; 35 Ill. Admin. Code 722.123, Use of the Manifest; 35 Ill. Admin. Code 722.130, Packaging; 35 Ill. Admin. Code 722.131, Labeling; 35 Ill. Admin. Code 722.132, Marking; 35 Ill. Admin. Code 722.133, Placarding; 35 Ill. Admin. Code 722.140, Recordkeeping; 35 Ill. Admin. Code 722.141, Annual Reporting; 35 Ill. Admin. Code 722.142, Exception Reporting; 35 Ill. Admin. Code 722.143, Additional Reporting; 35 Ill. Admin. Code 728.107, Waste Analysis and Recordkeeping; and 35 Ill, Admin. Code 728.109, Special Rules for Characteristic Wastes and Illinois Department of Transportation Regulations: 92 Ill. Admin. Code 171; 92 Ill. Admin, Code 172; 92 Ill. Admin. Code 173; and 92 Ill. Admin. Code 177.
- Irrespective of the hazardous waste determination, the washwater will be considered a special waste, thus, the following requirements will be **applicable**: 35 Ill. Admin. Code 808.121, Generator Obligations; 35 Ill. Admin. Code 808.240, Special Waste Classes; 35 Ill. Admin. Code 809.241, Default Classification of Special Wastes; 35 Ill. Admin. Code 808.242, Special Handling Waste; 35 Ill. Admin. Code 808,243, Wastes Categorized by Source; 35 Ill. Admin. Code 808.244, Wastes Categorized by Characteristics; 35 Ill. Admin. Code 808.245, Classification of Wastes; 35 Ill. Admin. Code 808 Subpart D, Request for Waste Classification; 35 Ill. Admin. Code 808 Subpart H,

Categorical and Characteristic Wastes; and 35 Ill. Admin. Code 808 Appendix A, Assignment of Special Waste to Classes; and 35 Ill. Admin. Code 808 Appendix B, Toxicity Hazard; 35 Ill. Admin. Code 809 Subpart B, Special Waste Hauling Permits; Subpart C, Delivery and Acceptance; Subpart D, Vehicle Numbers and Symbols; Subpart E, Manifests, Records and Reporting; Subpart F, Duration of Permits and; Subpart G, Emergency Contingencies for Spills.

Transportation requirements for RCRA hazardous waste

For all transportation of RCRA hazardous waste using state roads from the excavated areas to a central treatment area, the following Illinois Department of Transportation Regulations will be **applicable**: 92 Ill. Admin. Code 171; 92 Ill. Admin. Code 172; 92 Ill. Admin. Code 173; and 92 Ill. Admin. Code 177.

10.2.1.2.2 Land Disposal Restrictions: SRU1, SRU2, SRU3, SRU4 and SRU6

- Land disposal restrictions are triggered when RCRA hazardous contaminated soil is excavated from one unit, which in this case is deemed to be a landfill, and placed into another land-based unit (i.e., if the soil is later used for backfill at a different area or disposed of offsite at a RCRA Subtitle C or at the WCLF or other permitted facility after treatment). If land disposal restrictions are triggered, then the following substantive requirements will be **applicable**: 35 Ill. Admin. Code 728.101, Purpose, Scope and Applicability; 35 Ill. Admin. Code 728,103, Dilution Prohibited as a Substitute for Treatment; 35 Ill. Admin. Code 728.107, Waste Analysis and Record keeping; and 35 Ill. Admin. Code 728.109, Special Rules for Characteristic Wastes.
- For the waste codes D003, D006, D008, K046, K047, K1111, and any other wastes codes identified during excavation, the following corresponding sections of Illinois hazardous waste regulations, which prohibit land disposal of specifically identified wastes, will be **applicable**: 35 Ill. Admin. Code 728.133, Waste Specific Prohibitions: First Third Wastes; 35 Ill. Admin. Code 728.134, Waste Specific Prohibitions - Second Third Wastes; 35 Ill. Admin. Code 728.135, Waste Specific Prohibitions - Third Third Wastes; 35 Ill. Admin. Code 728.136, Waste Specific Prohibitions - Newly Listed Wastes, and 35 Ill. Admin. Code 728.139 Statutory Prohibitions.
- C.F.R. 268.39(c)(1997), which provides additional waste specific prohibitions, will be **applicable**. (Illinois has no equivalent state regulations.)
- If each identified waste meets individually assigned treatment standards, then the wastes may be land disposed. For the waste codes D003, D006, D008, K046, K047, K1111, and any other wastes codes identified during excavation, the corresponding specific regulations from the following treatment standards regulations will be **applicable**: 35 Ill. Admin. Code 728.140, Applicability of Treatment Standards; 35 Ill. Admin. Code 728.141, Treatment Standards expressed as Concentrations in Waste; 35 Ill. Admin. Code 728.142, Treatment Standards Expressed as Specified Technologies; 35 Ill. Admin. Code 728.143, Treatment Standards expressed as Waste Concentrations; 35 Ill. Admin. Code 728.144, Adjustment of Treatment Standards; 35 Ill. Admin. Code 728.145, Treatment Standards for Hazardous Debris; 35 Ill. Admin. Code 728.148, Universal Treatment Standards, 35 Ill. Admin. Code 728.150, Prohibitions on Storage of Restricted Wastes, 35 Ill. Admin. Code 728.Appendix J, Record keeping, Notification, and Certification Requirements (for any waste going off-site to a RCRA Subtitle C landfill, administrative as well as substantive requirements will be applicable); 35 Ill. Admin. Code 728.Table T, Treatment Standards for Hazardous Wastes, and 35 Ill. Admin. Code 728.Table U, Universal Treatment Standards.
- "If a media contaminated with a listed or characteristic hazardous waste is treated to the remediation goals specified in the ROD for the facility, the LDRs specified in 35 IAC 728, and no longer exhibits any characteristic of a hazardous waste, the media would not contain a RCRA listed or characteristic hazardous waste. However, unless the treatment method actually destroyed or removed the contaminants of concern from the media, the treated media might still be considered a special waste and, therefore, subject to the special waste regulations at 35 IAC 808 through 815."

> "Since the treated residues of K047, which exist in the North and South red water ash landfills [Sites M1 and M9] at JOAAP, no longer exhibit the characteristic of reactivity, they are not hazardous wastes under the regulation at 35 IAC 721.103(a)(2)(C)." [from letter from C. Grigalauski, IEPA, to A. Holz, JOAAP, dated July 24, 1998]

10.2.1.2.3 ARARs for Bioremediation: SRU1 and SRU3 (bioremediation alternative)

Note that ARARs are provided for the remedial activity of composting. If an alternate bioremediation technology is utilized under this alternative, the ARARs for the alternate technology, if different from those presented in these sections, will be identified and submitted to the USEPA and IEPA for review and approval prior to implementation of the remedy. Composting will be accomplished in remediation plies or in a containment building.

- If the Hazardous Contaminated Media Rule is finalized and adopted by Illinois prior to remediation, composting of RCRA hazardous waste could be accomplished though remediation piles, the piles would be considered as remediation piles under proposed 40 CFR 260.10 and proposed 40 CFR 264.544. These requirements would be **applicable** when Illinois adopts this rule.

- If composting is accomplished in a containment building, then the following Illinois requirements will be **applicable** to the containment building which treats RCRA hazardous waste: 35 Ill. Admin. Code 724.113, General Waste Analysis; 35 Ill. Admin. Code 724.114, Security, 35 Ill. Admin. Code 724.1100, Applicability; 35 Ill. Admin. Code 724.1101, Design and Operating Standards; 35 Ill. Admin. Code 724.1102, Closure and Post-closure Care; 35 Ill. Admin. Code 724.211, Closure Performance Standard; and 35 Ill. Admin. Code 724.214, Disposal or Decontamination of Equipment, Structures and Soils.

10.2.1.2.4 ARARs for Transportation and Disposal of Hazardous Waste at a Subtitle C Facility: SRU2, SRU3, and SRU6

Under one of the disposal options for SRU2 , SRU3, and SRU6, and portions of SRU2 (under both disposal options), excavated hazardous contaminated soil would be disposed offsite at a RCRA Subtitle C facility. For transportation of the contaminated soil off-site to the RCRA Subtitle C facility the following regulations will be **applicable**: 35 Ill. Admin. Code 722.134, Accumulation Time, 35 Ill. Admin. Code 724.271, Condition of Containers; 35 Ill. Admin. Code 724.272, Compatibility of Waste With Container; 35 Ill. Admin. Code 724.273, Management of Containers; 35 Ill. Admin. Code 724.275, Containment; and 35 Ill. Admin. Code 724.278, Closure, 35 Ill. Admin. Code 722.111, Hazardous Waste Determination; 35 Ill. Admin. Code 722.112, USEPA Identification Numbers; 35 Ill. Admin. Code 722.120, General Requirements; 35 Ill. Admin. Code 722.121, Acquisition of Manifests; 35 Ill. Admin. Code 722.122, Number of Copies; 35 Ill. Admin. Code 722.123, Use of the Manifest; 35 Ill. Admin. Code 722.130, Packaging; 35 Ill. Admin. Code 722.131, Labeling; 35 Ill. Admin. Code 722.132, Marking; 35 Ill. Admin. Code 722.133, Placarding; 35 Ill. Admin. Code 722.140, Record keeping; 35 Ill. Admin. Code 722.141, Annual Reporting; 35 Ill. Admin. Code 722.142, Exception Reporting; 35 Ill. Admin. Code 722.143, Additional Reporting; 35 Ill. Admin. Code 728.107, Waste Analysis and Record keeping; and 35 Ill. Admin. Code 728.109, Special Rules for Characteristic Wastes and Illinois Department of Transportation Regulations: 92 Ill. Admin. Code 17 1; 92 Ill. Admin. Code 172; 92 Ill. Admin. Code 173; and 92 Ill. Admin. Code 177.

In addition, the hazardous waste will be classified as a special waste; therefore, the following special waste regulations relating to manifesting and transport will be **applicable**: 35 Ill. Admin. Code 808.121, Generator Obligations; 35 Ill. Admin. Code 808.240, Special Waste Classes; 35 Ill. Admin. Code 808.241, Default Classification of Special Wastes; 35 Ill. Admin.Code 808.242, Special Handling Waste; 35 Ill. Admin. Code 808.243, Wastes Categorized by Source; 35 Ill. Admin. Code 808.244, Wastes

Categorized by Characteristics; 35 Ill. Admin. Code 808.245, Classification of Wastes; 35 Ill. Admin. Code 808 Subpart D, Request for Waste Classification; 35 Ill. Admin. Code 808 Subpart H, Categorical and Characteristic Wastes; and 35Ill. Admin. Code 808 Appendix A, Assignment of Special Waste to Classes; and 35 Ill. Admin. Code 808 Appendix B, Toxicity Hazard; 35 Ill. Admin. Code 809 Subpart B, Special Waste Hauling Permits; Subpart C, Delivery and Acceptance; Subpart D, Vehicle Numbers and Symbols; Subpart E, Manifests, Records and Reporting; Subpart F, Duration of Permits... and; Subpart G, Emergency Contingencies for Spills.

10.2.1.2.5 ARARs for Transportation and Disposal of Soil, Stones, and Debris to a Permitted RCRA Subtitle D Landfill

Excavated non-hazardous soil, soil with PCB levels less than 50 ppm, or hazardous soil treated to remove any hazardous characteristic and which meets LDRs may be transported and disposed off-site at a permitted RCRA Subtitle D landfill (WCLF or other permitted facility). In addition, any part of the bioremediation treatment area (SRU1 and SRU3) or associated buildings at the SRU's which are demolished for remediation, which cannot be salvaged will be disposed at WCLF or other permitted facility. Debris and large stones segregated from the excavated soil will be reused or properly disposed.

- For all non-hazardous soil, stones, and debris disposed of at WCLF or other permitted facility, the **applicable** criteria of 415 ILCS 5/22.48 for non-special waste certification will be met. The soil/stones/debris will be exempted from the requirements for a special waste using the generator certification process contained in 415 ILCS 5/22.48.

- For the treated soil sent to WCLF or other permitted facility, the hazardous waste will be treated to remove any characteristic and meet LDRs; thus, will no longer be considered a hazardous waste. For this treated hazardous waste, 35 Ill. Admin. Code 721.103 will be**applicable**. The soil may still be classified as a special waste; therefore, the following special waste regulations relating to manifesting and transport will be**applicable**: 35 Ill. Admin. Code 808.121, Generator Obligations; 35 Ill. Admin. Code 808.240, Special Waste Classes; 35 Ill. Admin. Code 808.241, Default Classification of Special Wastes; 35 Ill. Admin. Code 808.242, Special Handling Waste; 35 Ill. Admin. Code 808.243, Wastes Categorized by Source; 35 Ill. Admin. Code 808.244, Wastes Categorized by Characteristics; 35 Ill. Admin, Code 808.245, Classification of Wastes; 35 Ill. Admin. Code 808 Subpart D, Request for Waste Classification; 35 Ill. Admin. Code 808 Subpart H, Categorical and Characteristic Wastes; and 35 Ill. Admin. Code 808 Appendix A, Assignment of Special Waste to Classes; and 35 Ill. Admin. Code 808 Appendix B, Toxicity Hazard; 35 Ill. Admin. Code 809 Subpart B, Special Waste Hauling Permits; Subpart C, Delivery and Acceptance; Subpart D, Vehicle Numbers and Symbols; Subpart E, Manifests, Records and Reporting; Subpart F, Duration of Permits and; Subpart G, Emergency Contingencies for Spills.

10.2.1.2.6 ARARs for Use of Non-Hazardous Soil Below RGs or Bioremediated Below RGs as Backfill: SRU1, SRU2, SRU3, and SRU5

Under one of the disposal options for SRU1, SRU2, SRU3, and SRU5,the non-hazardous soil below RGs or non-hazardous soil bioremediated to RGs will be used as backfill or as subgrade. No environmental requirements have been identified to regulate the backfill and the subgrade of non-hazardous soil below RGs.

10.2.1.2.7 Additional ARARs Specific to SRU3: Explosives and Metals in Soil (Bioremediation and Disposal without Treatment Alternatives)

Solidification/Stabilization prior to disposal at WCLF or other permitted facility

- If soils are determined to be hazardous and are treated by stabilization/solidification on-site, then the following requirements will be **applicable** to the treatment unit : 35 Ill. Admin. Code 724.292, Design and Installation of New Tank Systems or Components; 35 Ill. Admin. Code 724.293, Containment and Detection of Releases; 35 Ill. Admin. Code 724.294 General Operating Requirements; 35 Ill. Admin. Code 724.295, Inspections; 35 Ill. Admin. Code 724.297, Closure and Post-Closure Care; 35 Ill. Admin. Code 724.211, Closure Performance Standard; and 35 Ill. Admin. Code 724.214, Disposal or Decontamination of Equipment, Structures and Soils.

10.2.1.2.8 Additional ARARs Specific to SRU4: PCBs in Soil

Disposal at a TSCA regulated landfill

- The following will be **applicable** to disposal at a TSCA regulated landfill: 40 CFR 761.65(c), Storage for Disposal; 40 CFR 761.60(d), 40 C.F.R. § 761.60(a)(4) (1997), Disposal Requirements; 40 C.F.R. § 761.75 (1997), Chemical Waste Landfills (PCB contaminated Soil must be sent to a USEPA approved chemical waste landfill, i.e., landfill must be in compliance with this section); 40 C.F.R. § 761.202 (1997), USEPA Identification numbers; 40 C.F.R. § 761.205(1997), Notification of PCB waste activity (USEPA Form 7710-53); 40 C.F.R. § 761.207(1997), The manifest - general requirements; 40 C.F.R. § 761.208(1997), Use of the manifest; 40 C.F.R, § 761.209(1997),Retention of manifest records; 40 C.F.R. 761.215(1997), Exception reporting; and 40 C.F.R. § 761.218(1997), Certificate of Disposal and Illinois Department of Transportation Regulations: 92 Ill. Admin. Code 171; 92 Ill. Admin. Code 172; 92 Ill. Admin. Code 173; and 92 Ill. Admin. Code 177.

- For any portions of the waste, which are also contaminated with RCRA characteristic waste, in addition to the ARARs identified above, the ARARs identified for transportation to a RCRA Subtitle C landfill listed in Section 10.2.1.2.4 will also be **applicable** for disposal at a TSCA/RCRA regulated landfill.

Off-site incineration - including transportation

- The following will be **applicable** to the remedial actions involving off-site incineration of PCB contaminated soil: 40 CFR 761.65 (c), Storage for Disposal; 40 CFR 761.60(d), Spills; 40 CFR 761.79, Decontamination., 40 C.F.R. § 761.60(a)(4) (1997), Disposal Requirements; 40 C.F.R. § 761.70 (1997), Incineration (PCB contaminated soil must be sent to an USEPA-approved incinerator, i.e., incinerator must be in compliance with this section); 40 C.F.R. § 761.202 (1997), USEPA Identification numbers; 40 C.F.R. § 761.205(1997), Notification of PCB waste activity (USEPA Form 7710-53); 40 C.F.R. § 761.207(1997), The manifest - general requirements; 40 C.F.R. § 761.208(1997), Use of the manifest; 40 C.F.R. § 761.209(1997), Retention of manifest records; 40 C.F.R. § 761.215(1997), Exception reporting; and 40 C.F.R. § 761.218(1997), Certificate of Disposal and Illinois Department of Transportation Regulations: 92 Ill. Admin. Code 171; 92 Ill. Admin. Code 172; 92 Ill. Admin. Code 173; and 92 Ill. Admin. Code 177.

- For any portions of the waste, which are also contaminated with RCRA characteristic waste, in addition to the ARARs identified above, the ARARs identified for transportation to a RCRA Subtitle C landfill listed in Section 10.2.1.2.4 will also be **applicable** for transportation of the mixed waste to a TSCA/RCRA regulated incinerator.

10.2.1.2.9 Additional ARARs Specific to SRU6: Landfills

Subtitle D caps

22. The **applicable** requirements associated with the placement of Subtitle D caps over the landfills are as follows: 35 Ill. Admin. Code 807.305, Cover; 35 Ill. Admin. Code 807.312, Air Pollution; 35 Ill. Admin. Code 807.313, Water Pollution; 35 Ill. Admin. Code 807.318, Completion or Closure Requirements; and 35 Ill. Admin. Code 807.502, Closure Performance Standard, 35 IAC

811.110, Closure; 35 IAC 8 11. 111, Post-closure Maintenance; 35 IAC 811.308, Leachate Collection System; 35 IAC 811.314, Final Cover System; and 35 IAC 811.319, Groundwater Monitoring Programs.

Subtitle C caps - including closure,postclosure and groundwater monitoring

- The **relevant and appropriate** requirements associated with closure and post-closure care are as follows: 35 Ill. Admin. Code 724.410, Closure and Postclosure Care;35 Ill. Admin. Code 724.211, Closure Performance Standard; 35 Ill. Admin, Code 724.214, Disposal or Decontamination of Equipment, Structures and Soils; and 35 Ill. Admin. Code 724.217, Post-Closure Care and Use of Property, 35 Ill. Admin. Code 811.110, Closure, 35 Ill. Admin. Code 811.811, Postclosure Maintenance, 35 IAC 724.216, Survey Plat; 35 IAC 724 219 Post-Closure Notices.

- The **relevant and appropriate** requirements associate with groundwater monitoring activities are as follows: 35 Ill. Admin. Code 724.190, Applicability; 35 Ill. Admin. Code 724.197, General Groundwater Monitoring Requirements; 35 Ill. Admin. Code 724.200, Corrective Action Program; and 35 Ill. Admin. Code 724.201, Corrective Action for Solid Waste Management Units.

10.2.1.2.10 SRU7: Sulfur (Preferred Alternative: Removal and Recycle or Disposal)
No environmental requirements have been identified to regulate the removal, recycling or disposal of the raw sulfur, other than the requirements common to all the SRUs and discussed in Section 10.2.1.2.1.

10.2.1.3 Location-specific ARARs and TBC Guidance for Soils OU

- Executive Order 11988, entitled “Floodplain Management”, May 24, 1977; 40 C.F.R. 6.302(b)(1997); 40 C.F.R. 6 Appendix A(1997) - **Applicable** for protection of floodplains during remedial actions at Site L4, SRU 6.

- Executive Order 11990, entitled “Protection of Wetlands”, May 24, 1977; 40 C.F.R. 6.302(a)(1997); 40 C.F.R. 6 Appendix A(1997) - **Applicable** for the avoidance and minimization of adverse impacts to wetlands during remedial actions at Site L4, SRU 6.

- Rivers & Harbors Act of 1899, Section 10. Section 10 permit required for structures or work in or affecting navigable waters. 33 USC 403, 33 CFR 320-330. - **Applicable**.

- Clean Water Act Section 404; 40 C.F.R. 230(1997); 33 C.F.R. 320-330(1997) - **Applicable** requirement to prohibit discharge of dredged or fill material into wetlands without a permit.

- Pertinent portions of the Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661*et seq*.); Clean Water Act Section 404, 40 C.F.R. 230, and 33 C.F.R. 320-330(1997) -**Applicable** requirement for federal agencies to take into consideration the effect that water-related remedial actions will have on fish and wildlife and take action to prevent loss or damage to these resources. Consultation with either the Fish and Wildlife Service or the State to develop measures to protect potentially affected wildlife is recommended.

- The following statutory and regulatory sections are **applicable** for the protection of the Upland Sandpiper (*Bartramia longicauda*), federal-listed endangered bird and state-listed endangered bird of Illinois: 16 USC 1531 *et seq*., 50 CFR 200, 50 CFR 402, Section 10/3 of the Illinois Endangered Species Act (520 ILCS 10/3), Possession, transportation, sale or disposition of animal or animal product unlawful; Section 10/7 (520 ILCS 10/7), Listing of endangered or threatened species-delisting; 17 Ill. Admin. Code 1010.30, Official List, adopted by the Illinois Endangered Species Protection Board as the Official List of Endangered and Threatened Fauna of Illinois; pertinent portions of 17 Ill. Admin. Code 1070, Possession of Specimens or Products of endangered or threatened species.

- Pertinent portions of 17 Ill. Admin. Code 1075, Consultation Procedures for Assessing Impacts of Agency Actions on Endangered and Threatened and Natural Areas, are**TBC guidance** for remedial activities at JOAPP.

- If any migratory birds impacted, Migratory Bird Treaty Act of 1918, 16 USC 703-711 is applicable.

10.2.2 Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) and To-Be-Considered (TBC) Guidance for Groundwater Operable Unit (OU).

10.2.2.1 Chemical-specific ARARs and TBC Guidance for Groundwater OU

Groundwater

The State of Illinois has established groundwater classifications as well as standards for groundwater, which are implemented by regulations promulgated at 35 Ill. Adm. Code 620. Groundwater in the shallow bedrock aquifer is classified as Class I groundwater (35 Il. Adm. Code 620.210 and groundwater in the uppermost or overburden aquifer (glacial drift aquifer) is classified as Class II groundwater (35Il. Adm. Code 620.220). Groundwater Management Zones (GMZs) will be established to provide protection for both aquifers. In addition, the SDWA MCLs are relevant and appropriate requirements for the remediation of the Class I groundwater in the shallow bedrock aquifer at JOAAP. Requirements associated with the GMZs are as follows:

- 35 Ill. Adm. Code 620.450 -**Applicable** requirement that, upon completion of a corrective action, the standards for such released chemical constituents are either (1) the standards specified in 35 Il. Adm. Code 620.4 10 and 3 5 Il. Adm. Code 620.420 for concentrations of chemical constituents in Classes I and II groundwater, respectively; or (2) the concentration determined by groundwater monitoring for such constituent and the exceedance has been minimized to the extent practicable, and beneficial use appropriate for that class has been returned; and any threats to human health and environment have been minimized.
- 35 Ill. Adm. Code 620.450(a) - **Applicable** groundwater restoration standards for any chemical constituents in groundwater within the Groundwater Management Zone prior to completion of a corrective action as described in 35 Il. Adm. Code 620.250(a).
- 35 Ill. Adm. Code 620.505(a.)(4.) - **Applicable** for a Groundwater Management Zone; compliance with standards is determined as specified in the corrective action process
- 35 Ill. Adm. Code 620.505(a.)(5.) -**Applicable**: compliance with standards will be determined at any point at which groundwater monitoring is conducted using a monitoring well that meets the conditions of 620.505(a.)(5.D.).
- 35 Il. Adm. Code 620.115 -**Applicable**: a prohibition against violations of the Illinois Environmental Protection Act (S.H.A. 415 ILCS 5/12. Acts Prohibited) and the Illinois Groundwater Protection Act (S.H.A. 415 ILCS 55/1 - 55/9).

In addition, due to the direct hydrological connection between groundwater and the surface water bodies at JOAAP (Prairie Creek, Jackson Creek, and Grant Creek), protection of these surface water bodies must be considered. The appropriate CWA and Illinois Water Quality Standards at 40 CFR Part 131 and 35 Il. Adm. Code 302, Subparts B and D for the chemical constituents of concern in groundwater, based on the use class designations of the affected waterbodies, will be met in the surface water bodies downstream of the hydrological connection with the groundwater.

ARARs and TBCs necessary for protection must be attained for hazardous substances, pollutants, or contaminants remaining on-site at the completion of the remedial actions.

10.2.2.1.1 GRU1: Explosives in Groundwater

- **TBC guidance:** values calculated based on EPA and IEPA guidance (see Section 10.2.1.1 for references) for explosives - 2,4-dinitrotoluene (0.02 µg/L); 2,6- dinitrotoluene (0.31 µg/L); 1,3,5-trinitrobenzene (0.35µg/L); 2,4,6-trinitrotoluene (3.5 µg/L); RDX (2 µg/L); HMX (260 µg/L);:

10.2.2.1.1 GRU2: Explosives and Other Contaminants in Groundwater

- 35 Il Adm. Code 620.410 (1997) - At completion of the remedy, **applicable** standards for Class I groundwater in the shallow bedrock aquifer; 40 CFR Part 141.62 (1997) - At completion of the remedy, **Relevant and Appropriate** Maximum Contaminant Levels for groundwater in the shallow bedrock aquifer:
  -for Class I groundwater for metals: antimony (6 µg/L); cadmium (5 µg/L); and iron (5000 µg/L).
  -for Class I groundwater for sulfates (400,000 µg/L);
  -for Class I groundwater for perchloroethene (5 µg/L); toluene (1000 µg/L); and 1,2-dichloroethane (5 µg/L).
- 35 Il. Adm. Code 620.420 (1997) - At completion of the remedy, **applicable** standards for Class II groundwater in the uppermost or overburden aquifer (glacial drift aquifer):
  -for Class II groundwater for metals: antimony (24 µg/L); cadmium (50 µg/L); and iron (5000 µg/L);
  -for Class II groundwater for sulfates (400,000 µg/L)
  -for Class II groundwater for perchloroethene (25 µg/L); toluence)2500 µg/L); and 1,2-dichloroethane (25 µg/L).
- **TBC guidance**: values calculated based on IEPA guidance for explosives at completion of the remedial action - 2,4-dinitrotoluene (0.02 µg/L); 2,6-dinitrotoluene (0.31 µg/L); 1,3,5-trinitrobenzene (0.35 µg/L); 2,4,6-trinitrotoluene (3.5 µg/L); RDX (2 µg/L); 2-nitrotoluene (70 µg/L); nitrobenzene (3.5 µg/L); and 1,3-dinitrobenzene (0.7 µg/L).

10.2.2.1.3 GRU3: Volatile Organic Compounds in Groundwater

- 35 Il. Adm. Code 620.410 (1997) - At completion of the remedy, **applicable** standard for Class I groundwater in the shallow bedrock aquifer; 40 CFR part 141.62 (1997) - At completion of the remedy, **Relevant and Appropriate** Maximum Contaminant Level for groundwater in the shallow bedrock aquifer:
  -for Class I groundwater for toluene (1000 µg/L).
- 35 Il. Adm. Code 620.420 (1997) - At completion of the remedy, **applicable** standard for Class II groundwater in the uppermost or overburden aquifer (glacial drift aquifer):
  -for Class II groundwater for toluene (2500 µg/L).

10.2.2.2 Action-specific ARARs and TBC Guidance for Groundwater

- 35 Il. Adm. Code 620.250 - **Applicable** to the establishment of a Groundwater management Zone to mitigate impairment caused by release of contaminants.
- 25 Ill. Adm. Code 620.405 - **Applicable** prohibition against the release of any contaminant to groundwater during remedial activities at JOAAP.
- 35 Ill. Adm. Code 620.510 - **Applicable** requirements for monitoring and sampling.

- Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites, USEPA OSWER Directive 9200.4-17, November 1997 -**TBC guidance** for use of monitored natural attenuation at GRUs at JOAAP.

Substantive portions of 35 Ill. Adm. Code 742 Subpart J - will be followed for institutional controls to be placed on the property (35 Ill. Adm. Code 742.1000) and for issuance of No Further Remediation Letters, Restrictive Covenants, Deed Restrictions and Negative Easements, and Local Ordinances. (35 Ill. Admin. Code 742.1005, 742.1010, and 742.1015.)

10.2.2.3 Location-specific ARARs and TBC Guidance for Groundwater

- Executive Order 11988, entitled "Floodplain Management", May 24, 1977; 40 C.F.R. 6.302(b)(1997); 40 C.F.R. 6 Appendix A(1997) - **Applicable** for protection of floodplains during remedial actions at Site L4, SRU 6.
- Executive Order 11990, entitled "Protection of Wetlands", May 24, 1977; 40 C.F.R. 6.302(a)(1997); 40 C.F.R. 6 Appendix A(1997) - **Applicable** for the avoidance and minimization of adverse impacts to wetlands during remedial actions at Site L4, SRU 6.
- Rivers & Harbors Act of 1899, Section 10. Section 10 permit required for structures or work in or affecting navigable waters. 33 USC 403, 33 CFR 320-330. **Applicable.**
- Clean Water Act Section 404, 40 C.F.R. 230(1997); 33 C.F.R. 320-330(1997) - **Applicable** requirement to prohibit discharge of dredged or fill material into wetlands without a permit.
- Pertinent portions of the Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661 et seq.); Clean Water Act Section 404, 40 C.F.R. 230, and 33 C.F.R. 320-330(1997) -**Applicable** requirement for federal agencies to take into consideration the effect that water-related remedial actions will have on fish and wildlife and take action to prevent loss or damage to these resources. Consultation with the U.S. Fish and Wildlife Service and the State of Illinois to develop measures to protect potentially affected wildlife is recommended.
- The following statutory and regulatory sections are **applicable** for the protection of the Upland Sandpiper (Bartramia longicauda), state-listed endangered bird of Illinois: Section 10/3 of the Illinois Endangered Species Act (520 ILCS 10/3), Possession, transportation, sale or disposition of animal or animal product unlawful; Section 10/7 (520 ILCS 10/7), Listing of endangered or threatened species-delisting; 17 Ill. Admin. Code 1010.30, Official List, adopted by the Illinois Endangered Species Protection Board as the Official List of Endangered and Threatened Fauna of Illinois; pertinent portions of 17 Ill. Admin. Code 1070, Possession of Specimens of Products of endangered or threatened species.
- If any migratory birds impacted, Migratory Bird Treaty Act of 1918, 16 USC 703-711 is applicable.

Pertinent portions of 17 Ill. Admin. Code 1075, Consultation Procedures for Assessing Impacts of Agency Actions on Endangered and Threatened and Natural Areas, are **TBC guidance** for remedial activities at JOAAP.

10.3 Cost Effectiveness

10.3.1 Soil OU

The selected final and interim remedies for the SOU provide overall effectiveness proportionate to its costs. Although other remedies have lower or higher costs, the selected remedies were chosen because they have the best cost/benefit ratio. After balancing short- and long-term effectiveness and permanence, reduction in toxicity, mobility or volume of contaminant, and implementability to the overall cost of the selected remedies, the ratio of these criteria to cost is the best for the selected remedies compared to the other remedies. The overall net present worth cost of capital and operational and maintenance cost for the SOU remedies is estimated to be $84,000,000.

__10,3.2 Groundwater OU__

The selected remedy for the GOU provides an overall effectiveness proportionate to its costs. When compared to more expensive remedies, the selected remedy (Limited Action) for all the GRUs was found to be generally as effective but definitely easier to implement. The major problem with using a more aggressive remedy is that it would require pumping the groundwater out of the glacier drift aquifer, which has a very low groundwater yield. The overall net present worth cost of capital and operational and maintenance cost for theGOU remedy is estimated to be $4,530,000.

10.4 Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable

The Army, the USEPA, and the IEPA have determined that the selected final and interim remedies represent the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the JOAAP soil and groundwater OUs. The Army, the USEPA, and the IEPA have selected alternatives that are protective of human health and the environment and comply with ARARs. In addition, the Army, the USEPA, and the IEPA have determined that these selected remedies provide the best balance of tradeoffs between the five balancing criteria while considering the statutory preference for treatment as a principal element and State and community acceptance.

__10.4.1 Soil OU__

10.4.1.1 SRU1: Explosives in Soil

The selected final and interim remedies, Bioremediation, provide the best balance among the five alternatives evaluated against the nine evaluation criteria. Based on available information, the selected interim and final remedies utilize permanent solutions to the maximum extent practicable, and satisfy the RAOs. Of the five statutory criteria met, reduction in toxicity, mobility, and volume, and long-term effectiveness and permanence were the most critical in the selection process.

Bioremediation is recommended over Incineration because it is less expensive and Incineration may face difficulty in gaining public acceptance. Incineration may also require granting a waiver because of existing air regulations. Although more expensive than Excavation and Disposal, Bioremediation is recommended because it will treat the soils at JOAAP that pose the majority of the risk to human health and the environment. This will also satisfy the regulatory preference of CERCLA for treatment over disposal.

10.4.1.2 SRU2: Metals in Soil

The selected final and interim remedies, Excavation and Disposal, provide the best balance among the four alternatives evaluated against the nine evaluation criteria. Based on available information, the selected remedies utilize permanent solutions to the maximum extent practicable, and satisfy the RAOs. Of the five statutory balancing criteria, reduction in toxicity, mobility, and volume, and cost-effectiveness were the most critical in the selection process. By choosing Excavation and Disposal, this alternative will be less costly and, when compared to theSolidification/Stabilization, will reduce the volume of material needed to be placed in the landfill. The Excavation and Disposal alternative provides an added benefit in that the soil may be suitable for use as subgrade material for the proposed on-site landfill caps in SRU6. This option may allow the soil to be used as fill for on-sitelandfill caps that would not increase project costs, would be protective to human health and the environment, and would not use up available space in the future proposed WCLF.

10.4.1.3 SRU3: Explosives and Metals in Soil

The selected final and interim remedies, Bioremediation and Disposal and Excavation and Disposal, provide the best balance among the five alternatives evaluated against the nine evaluation criteria. Based on available information, the selected remedies utilize permanent solutions to the maximum extent practicable, and satisfy the RAOs. Two alternatives were selected for this SRU because sites M5 and M6 might contain soil that exhibit hazardous characteristics (i.e., explosives concentration > 100,000 ppm) or contain RCRA-listed wastes, and therefore these soils will require treatment for explosives prior to disposal in a landfill. Since soils from both of these alternatives may be disposed in a landfill, just excavating and disposing of non-hazardous soils will be less costly and will represent a smaller volume of material to be placed in the landfill than treating soil. The selection of these two alternatives was recommended over Incineration because this approach is less expensive and Incineration may face difficulty in gaining public acceptance. Incineration may also require granting of a waiver because of existing air regulations.

10.4.1.4 SRU4: PCBs in Soil

The selected final remedy, Excavation/Incineration and Disposal, provides the best balance among the five alternatives evaluated against the nine evaluation criteria. Based on available information, the selected remedy utilizes permanent solutions to the maximum extent practicable, and satisfies the RAOs. Of the five statutory criteria met, implementability and cost-effectiveness were the most critical in the selection process. The threshold criteria could be met by the recommended alternative, by Chemical Dehalogenation and by On-site Low-temperature Thermal Desorption (LTTD). Each would reduce the risk of direct contact with the PCBs in the soil and debris. However, the implementability, short-term effectiveness, and State acceptability of Excavation and Disposal make it more attractive than Chemical Dehalogenation and LTTD.

10.4.1.5 SRU5: Organics in Soil

The selected final and interim remedies, Excavation and Disposal, provide the best balance among the six alternatives evaluated against the nine evaluation criteria. Based on available information, the selected final and interim remedies utilize permanent solutions to the maximum extent practicable, and satisfy the RAOs. Of the five statutory criteria met, implementability and cost-effectiveness were the most critical in the selection process. The threshold criteria could be met by this alternative and by Bioremediation, Solvent Extraction, and On-site Low-temperature Thermal Desorption. Each Would reduce the risk of direct contact with the organic compounds in the soil and debris. However, Excavation and Disposal is easier to implement, can be implemented in a quicker time frame, and has a lower cost.

10.4.1.6 SRU6: Landfills

The selected final remedies, Capping and Excavation and Disposal, provide the best balance among the four alternatives evaluated against the nine evaluation criteria. Based on available information, the selected final remedies utilize permanent solutions to the maximum extent practicable, and satisfy the RAOs. Of the five statutory criteria met, reduction in toxicity, mobility, and volume, and long-term effectiveness and permanence were the most critical in the selection process.

The U.S. Army determined that Capping of the landfills in L3, M11 and M13 and Excavation and Disposal of soils in L4, M1 and M9 would best serve the cleanup requirements of the sites in SRU6. These recommended alternatives would be expensive, however, they would reduce the risks of direct contact with human and the environment. Because the potential presence of UXO poses workers safety issues, Capping rather than Excavation and Disposal was selected for L3.

10.4.1.7 SRU7: Sulfur

The selected final remedy, Removal and Recycle or Disposal, provides the best balance among the three alternatives evaluated against the nine evaluation criteria. Based on available information, the selected remedy utilizes permanent solutions to the maximum extent practicable, protects human health and the environment, and satisfies the RAOs. Of the five statutory criteria met, reduction in toxicity, mobility, and volume, and long-term effectiveness and permanence were the most critical in the selection process. This selected remedy may provide an innovative and beneficial resource recovery of the sulfur and would not increase project costs.

10.4.2 Groundwater OU

10.4.2.1 GRU1: Explosives in Groundwater

The selected final remedy, Limited Action, provides the best balance among the three alternatives evaluated against the nine evaluation criteria. Based on available information, the selected remedy utilizes permanent solutions to the maximum extent practicable, protects human health and the environment, and satisfies the RAOs. Of the five statutory criteria met, long-term effectiveness and permanence, implementability, and cost-effectiveness were the most critical in the selection process. This remedy relies on the treatment or removal of contaminated soil that is the primary source for continuing groundwater contamination.

10.4.2.2 GRU2: Explosives and Other Contaminants in Groundwater

The selected final remedy, Limited Action, provides the best balance among the five alternatives evaluated against the nine evaluation criteria. Based on available information, the selected remedy utilizes permanent solutions to the maximum extent practicable, protects human health and the environment, and satisfies the RAOs. Of the five statutory criteria met, implementability and cost-effectiveness were the most critical in the selection process. This remedy relies on the treatment or removal of contaminated soil that is the primary source for continuing groundwater contamination.

10.4.2.3 GRU3: Volatile Organic Compounds in Groundwater

The selected final remedy, Limited Action, provides the best balance among the six alternatives evaluated against the nine evaluation criteria. Based on available information, the selected remedy utilizes permanent solutions to the maximum extent practicable, protects human health and the environment, and satisfies the RAOs. Of the five statutory criteria met, implementability and cost-effectiveness were the most critical in the selection process. This remedy relies on the treatment or removal of contaminated soil that is the primary source of continuing groundwater contamination.

10.5 Preference for Treatment as a Principal Element

10.5.1 Soil OU

The selected final and interim remedies meet the NCP's expectations to treat principal threat wastes and contain low level threats. Investigations conducted at the site yielded an estimated total of approximately 912,000 cubic yards of soil contaminated above the remediation goals requiring cleanup. The contaminants found at the highest concentrations at JOAAP, or the principal threat wastes, are explosives in soil. Treatment (bioremediation) is selected for SRU1 and SRU3, which represents approximately 185,000 cubic yards of explosives contaminated soil. Containment alternatives (excavation and on-site or off-site disposal) were selected for approximately 718,000 cubic yards of contaminated soil which do not pose a principal threat. The final and interim remedies selected for the Soil OU represents a good balance between containment and treatment.

10,12 Groundwater OU

The preference for active treatment of groundwater as a principal element in the selected final remedy is not generally met. Some treatment due to natural attenuation processes will occur within the three GRUs. In addition, removal and treatment or disposal of the contaminated soil will eliminate or reduce a major source of groundwater contamination. Therefore, if groundwater is only considered, then the preference for treatment as a principal element is not met.However, when considering that part of the groundwater remedy is soil treatment then the preference for active treatment as a principal element of the selected remedy for the JOAAP area is met. It should also be noted that active treatment of groundwater might not be extremely implementable. Any active treatment of the groundwater OU will require the withdrawal of groundwater from or the injection of nutrient into the glacier drift aquifer, which has a very low groundwater injection/withdrawaI yield. The low permeability of the glacial drift aquifer will make nutrient injection or water pumping difficult and limit the effectiveness of the active treatment.

Currently, there are no human or ecological receptors of the groundwater. These aquifers are not being used. The deed restrictions and the establishment of GMZs will ensure that no pathway, contact or exposure routes will be created.

[END OF SECTION]

11 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plans for the Soil and Groundwater OUs at the JOAAP were issued for public comment on December 12, 1997. The soil Proposed Plan identifiedpreferred alternatives for each of seven SRUs as well as 29 No Further Action sites with respect to soil at the JOAAP. The groundwater Proposed Plan identified preferred alternatives for three GRUs as well as 42 No Further Action sites with respect to groundwater at the JOAAP. A public meeting on both Proposed Plans was held on January 8, 1998. The public comment period ended on January 15, 1998. Forty-two sets of written comments were received as well as 28 formal oral comments.

As a result of comments received from USDA during finalization of the ROD regarding the protectiveness of the remedies, the Army, USEPA and IEPA have determined the actions proposed for SRUs 1, 2, 3 and 5 on USDA lands will be interim actions. All other actions are considered final actions. Upon review of the comments, it was determined that no other significant changes to the remedies, as originally identified in both Proposed Plans, were necessary.

11.1 Documentation of Other Changes

There are some minor differences in the information presented in the Feasibility Studies, and the Proposed Plans, on which this Record of Decision is based. These differences resulted from new information and from corrections of calculation errors discovered in the cost tables. These differences are summarized as follows:

- An additional GMZ surrounding Site M3 has been established as shown in Figure 4. This GMZ was added because benzene, detected in monitoring well MW233 in 1991, meets Class 11 standards but does not meet Class I standards.
- Following publication of the Proposed Plan, the Army, USEPA and IEPA determined that the contingency action for each GRU need not necessarily be pump and treat of the contaminated groundwater. Rather, if and when the need for a contingency action is identified, the Army will evaluate and recommend remedial action(s) that must then be approved by the UEPA and IEPA in accordance with the NCP.
- The cost of the Excavation and Disposal remedy for SRU3 has been recalculated because of an arithmetic error. It is estimated to be $2,800,000. As a result of this change, the estimated total cost of SRU3 increased from $4,400,000 to $6,800,000.
- The Army will evaluate the risk to prairie workers from exposure to soil contamination at JOAAP. See Section 6.1.2 for details.
- A site-specific JOAAP Biological Technical Assistance Group (BTAG) will be formed to establish exposure levels for ecological resources. See Section 6.2.2 for details.
- IEPA has sent the following clarifications on several issues related to RCRA hazardous wastes:

> “If a media contaminated with a listed or characteristic hazardous waste is treated to the remediation goals specified in the ROD for the facility, the LDRs; specified in 35 IAC 728, and no longer exhibits any characteristic of a hazardous waste, the media would not contain a RCRA listed or characteristic hazardous waste. However, unless the treatment method actually destroyed or removed the contaminants of concern from the media, the treated media might still be considered a special waste and, therefore, subject to the special waste regulations at 35 IAC 808 through 815.
>
> Since the treated residues of K047, which exist in the North and South red water ash landfills [Sites M1 and M9] at JOAAP, no longer exhibit the characteristic of reactivity,

they are not hazardous wastes under the regulation at 35 IAC 721.103(a)(2)(C)." [*letter from C. Grigalauski, IEPA, to A. Holz, JOAAP, dated July 24, 1998*]

Due to this clarification, delisting of. the redwater ash prior to disposal, as presented in the Proposed Plan, is no longer necessary.

[END OF SECTION]

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[END OF SECTION]

COMMUNITY PARTICIPATION RESPONSIVENESS SUMMAR
Joliet Army Ammunition Plant
Record of Decision

RS 0 Overview

The *Proposed Plan for the Soils Operable Unit* and the *Proposed Plan for the Groundwater Operable Unit* were released on December 12, 1997. Copies of the Proposed Plans were mailed to those persons who had expressed an interest. Copies were also made available at the information repositories (at JOAAP, the Wilmington Public Library and the Joliet Public Library).

In accordance with Section 117, of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, 42 U.S.C. Section 9617, the U.S. Army held a public comment period from December 12, 1997 to January 15, 1998, a period of thirty-four days. A public meeting was held on January 8, 1998 at the Wilmington City Council Chamber. Over one hundred persons attended the meeting. At that meeting, the U.S. Army presented the Proposed Plans and responded to questions from the floor. In addition, and in a separate room, formal oral comments were recorded for inclusion in the docket.

Notifications were placed in the two primary local newspapers concerning the Proposed Plans, public comment period and the public meeting.

The Restoration Advisory Board was briefed on the Proposed Plans on December 9, 1997, met again for discussion on the issues on January 7, 1998, and met a third time on January 22, 1998 to further discuss and to vote on the proposals. Per prior arrangement, the Army agreed to receive comments from the RAB following their meeting on January 22, 1998.

The purpose of this Responsiveness Summary is to document the Army's responses to comments received during the public comment period. These comments were considered prior to selection of the final remedy for soil and groundwater contamination at the Joliet Army Ammunition Plant. The remedy is documented in The U.S. Army's Record of Decision, with concurrence from Illinois EPA (IEPA) and USEPA.

Seventy-one sets of comments were received: 42 were written, 29 were recorded and transcribed oral statements. A total of 217 issues were raised by the 71 commenters. Thecomments were evaluated and subdivided by subject matter into the following six major groups and 26 subgroups.

1. **Objectives** (13/217 = 6%)
   Protect Human Health and the Environment
   Remediation Goals
   Protection of the Prairie and the VA Cemetery

2. **Remediation technology** (48/217= 22%)
   General Support
   Remedial Alternative Contingency Plans
   Preference to Excavate and Dispose
   Dependency on WCLF
   Natural Attenuation
   Issue Clarification

3. **Operational Issues** (12/217 = 6%)
   RCRA Wastes
   Deed Restrictions
   Stormwater Runoff

4. **Monitoring** (11/217 = 5%)
   Groundwater Monitoring
   Monitoring: LTM
   Monitoring: Biomonitoring

5. **Implementation** (107/217 = 49%)
   Expedite Implementation
   Use Local Labor
   Use Union Labor
   Emphasize Industrial Park
   Improve Tax Base
   Schedule

6. **Other Issues** (26/217 = 12%)
   Removal of UXOs
   Sulfur Cleanup
   Presentation: Nature and Extent
   Groundwater Plumes
   Various Other Comments

Comments and Responses Summarized by Concern

The categorization and cross-referencing of comments from the seventy-one (71) commenters is summarized in Table RS-1. The comments are discussed and responded to according to these groupings within Sections RS 1 through RS 7 of this Responsiveness Summary. In cases where single comments were made regarding an issue the comment or portions of it are directly quoted. In cases where multiple comments were made by different commenters, a representative summary of the comment is given. Citations for individual commenters are shown in brackets at the end of a specific comment or issue statement. The citations are in the form [mm.xx], where "mm" identifies the commenter and "xx" identifies the paragraph in which the comment was made.

RS 0.1 Background on Community Involvement

The high interest in implementation issues (49 %) focused on three primary concerns: remediate the site quickly; use local or union labor in performing remedial actions; and improvement of the tax base. These comments are important to the local citizens and labor pool. The Army has heard these concerns, is sensitive to them and will address them within remedial action implementation. These concerns do not have an impact on the choice of remedial alternatives - only on the implementation.

Six of the commenters who requested expedited action or use of local labor also requested that excavation and disposal be used instead of bioremediation. [3.3, 11.3, 32.2, 47.8, 52.5, 53.1 and 53.3] There appears to be two underlying reasons for this request. First is the belief that more money would come into the local economy with excavation and disposal than with bioremediation activities. Second is the belief that excavation and disposal would be completed sooner and thus allow an earlier transfer of the JOAAP property to the industrial parks (and its other designated uses) and creation of jobs for the local economy. It is the Army's position that while these are important objectives, they do not outweigh the primary objectives of the remedial actions at JOAAP - protection of human health and the environment - and, thus, these are insufficient reason for changing the choice of remedial alternatives. Incidentally, neither of the underlying beliefs by those recommending excavation and disposal over bioremediation is necessarily true. Because soil is moved at least twice in centralized bioremediation, there is more labor involved in this alternative than in the excavation and disposal. Furthermore, because of the probable two or more year lead time to open WCLF, bioremediation may be able to begin earlier and to finish at nearly the same time as excavation and disposal.

A private contractor presented an unsolicited proposal, within the comments [34], to excavate, stabilize/solidifyand dispose explosives-contaminated soils. The Army can not accept this proposal outside of normal Federal Acquisition Regulations. However it should be noted that in its Feasibility Studies, the Army did evaluate options similar to those proposed. On the basis of those Feasibility

Studies, bioremediation was selected as a proven technology for degrading explosives contamination within soils. In so doing, bioremediation will protect human health and the environment and will comply with the statutory preference for treatment to permanently reduce toxicity, mobility and volume. The commenter's proposal therefore was considered, but did not warrant a change in the Army's planned approach. Fifteen (15) commenters stated general approval of the selected remedies. [1.1 and 1.2, 2.1, 5.1, 6.1 and 6.2, 7.1, 8.1 and 8.6, 14.1, 15.1, 26.2, 35.1, 38.2-38.6,39.2,40.1.1, 42.2, and 49.1]

Thirteen commenters requested (i) consideration of remediation goals that were more protective of the environment, [4.3-4.7, 34.5, 71.5] (ii) that a biomonitoring program be incorporated into the remedial actions, [7.4] and/or (iii) that the Army provide more information about the impact of natural attenuation on soils and groundwater containing contamination below the accepted RGs. [7.2, 8.2, 22.2, 23&24.G1, 24.4, 34.4, 40.2, 41.1, 71.1] The Army believes that the final RGs established for protection of human health are also adequately protective of the environment. Studies conducted at JOAAP have demonstrated a healthy ecosystem even with contaminated "hot spots" in place. A site-specific JOAAP Biological Technical Assistance Group (BTAG) will be formed to establish exposure levels for ecological resources that are protective of the environment and compatible with development of the tallgrass prairie. The Army, USEPA and IEPA will consider the advise of the BTAG as they evaluate the need for a biomonitoring plan and for further study of natural attenuation.

Other comments concerned issues that modify specific aspects of the recommended remedial actions, procedures followed by the Army in developing the planned approach, or the presentation of the information within the ROD.

TABLE RS-1: RESPONSIVENESS SUMMARY: Proposed Plan Comment Cross References

Commenter #	Commenter (Name, and Affiliation or Town)	1. Objectives			2. Remediation Technology						3. RA Operational Issues			4. Monitoring			5. Implementation						6. Miscellaneous					Total Comments by Commenter
		1.1 Protect Human Health & Environment	1.2 Remediation Goals	1.3 Protect Prairie & Cemetery	2.1 General Support	2.2 Bioremediation Backup	2.3 Excavate and Dispose	2.4 Dependency on WCLF	2.5 Natural Attenuation	2.6 Clarification	3.1 RCRA Wastes	3.2 Deed Restrictions	3.3 Stormwater Runoff	4.1 Groundwater Monitoring	4.2 Long-Term Monitoring	4.3 Biomonitoring	5.1 Speedup	5.2 Local Labor	5.3 Union Labor	5.4 Emphasize Industrial Park	5.5 Improve Tax Base	5.6 Schedule	6.1 Removal of UXOs	6.2 Sulfur Cleanup	6.3 Presentation of Nature and Extent	6.4 Groundwater Plumes	6.5 Miscellaneous	
1	Steven M. Wierema, Fries Walters Co.			■	■																		■					3
2	Donna Shehane, Will County Land Use Department				■							■																2
3	Richard Kwasneski, Joliet Arsenal Development Authority																■			■	■							3
4	John Rogner, USDOI, Fish and Wildlife Service		■																									1
5	Gerald W. Heinrich, Sierra Club -- Sauk-Calumet Group			■	■							■											■					4
6	Gerald W. Heinrich, Sierra Club -- Sauk-Calumet Group			■	■																							2
7	Charles T. Grigalauski, IEPA - Bureau of Land		■		■				■		■		■			■						■	■	■				9
8	Charles T. Grigalauski, IEPA - Bureau of Land				■	■			■			■		■														5
9	Terri Blake Myers, IEPA													■														1
10	Rob Watson, IEPA		■								■																	2
11	Scott L. Pavlis, Local Union No 75; Laborers' International Union						■										■		■									3
12	H. Kent Austin, USDA, Forest Service					■																						1
13	H. Kent Austin, USDA, Forest Service					■		■							■													3

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14	Sharon T. Comstock, Sierra Club -- Chicago Group				■							■											■					3
15	Sharon T. Comstock, Sierra Club -- Chicago Group				■							■																2
16	Robert Habada, Lockport, IL																■	■		■								3
17	John Reddy, Joliet, IL	■																										1
18	John Reddy, Joliet, IL							■																				1
19	Ray Sundine, Wilmington, IL																■	■			■							3
20	Laura Reason, Elwood, IL																				■							1
21	Eric Gunty, Romeoville, IL																■			■	■						■	4
22	Laura Clark, Wilmington, IL					■			■	■																		3
23	Diana Mally, USEPA Region V		■			■			■	■	■					■								■	■			8
24	Diana Mally, USEPA Region V		■						■			■		■														4
25	Douglas Vaughn, Bourbonnois, IL																■		■		■							3
26	Andy Neill, Crest Hill, IL				■																							1

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27	Debra Rice, Elwood, IL																■	■			■							3
28	Janice A. Foote, Braidwood, IL																	■			■							2
29	Jeffrey Blatti, Elwood, IL					■	■													■	■							4
30	K.W. Cargle, Minooka, IL																■	■			■							3
31	Frank Studer, Wilmington, IL																■			■	■							3
32	Michael J. Quigley, Will & Grundy Counties Building Trades Council						■										■	■	■	■	■						■	7
33	Danny G. Kohrdt, Transportation Development Group						■										■					■					■	4
34	Stephen K. Davis, IL Dept.of Nat. Resources/Waste Mgmt & Resrch Cntr	■	■						■							■							■		■		■	7
35	Bill Pyziak, Manhattan, IL				■																	■						2
36	Thomas F. Ryan, Plainfield, IL																■	■	■		■							4
37	Martin Schell, Hinsdale, IL											■																1
38	Marcy Stewart- Pyziak, Midewin Tall Grass Prairie Association				■	■						■		■								■						5
39	Claire M. Wilson, Midewin Tall Grass Prairie Association				■																	■						2

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40	Robert J. Bowden, RAB				■	■			■					■												■		5
41	Robert J. Bowden, RAB		■						■						■													3
42	Jane E. Jones, Midewin Tallgrass Prairie Alliance				■																							1
43	Marianne L. Hahn, Audubon Council of Illinois									■																	■	2
44	Rhonda Norman, ., IL																■			■	■							3
45	Russ White, Wilmington, IL																■			■	■							3
46	Matty Becker, Manhattan, IL																■	■			■							3
47	Rick Kwasneski, Joliet Arsenal Development Authority					■											■	■		■	■							5
48	Kathy Brockett, Elwood, IL																			■	■						■	3
49	Sandor Brattstrom, ., IL				■													■		■	■							4
50	Dan Kohrdt, ., IL					■	■										■								■		■	5
51	Laura Reason, Elwood Community Church																										■	1
52	Kris Hermenson, Local Union 150						■										■	■		■								4

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53	Tony Izzareli, ., IL																■	■			■							3
54	Joe Amelse, Local Union 150																■	■										2
55	Steve Perkins, ., IL																■	■										2
56	Jim Smith, Local Union 150																■	■	■		■							4
57	Denise Issert, Wilmington, IL																■				■							2
58	Erik Smith, ., IL																■	■	■									3
59	Glen Troutman, ., IL																■		■									2
60	Todd Wachowski, Peotone, IL																	■									■	2
61	Pam Arnold, Elwood, IL																■				■							2
62	Kenneth Arnold, ., IL						■														■						■	3
63	Kellen Arnold, ., IL																■				■							2
64	Tom Gruben, Local Union 150																	■										1
65	Ben Stenemeyer, Local Union 150																■	■										2

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66	Dan Regan, Local Union 150																■	■										2
67	Terry Waldron, LaSalle, IL																■	■									■	3
68	Tim Zidwok, Local Union 150																■		■		■							3
69	Jeff Skinner, ., IL																■	■										2
70	Frank Schillinger, Local Union 150																■	■			■						■	4
71	USEPA National Remedy Review Board		■			■			■	■						■								■		■	■	8
	Total Comments by Subgroup	2	8	3	15	11	7	2	9	4	3	8	1	5	2	4	33	23	8	12	26	5	5	3	3	2	13	217
	Total Comments by Group	13			48						12			11			107						26					217

RS 1 Objectives

Eleven commenters expressed concern with the objectives of the proposed remedial actions related to the following three categories: (1) the protection of human health and the environment, (2) the choice of remediation goals (RGs), and (3) the protecti6n of the land for the designated users (MidewinTallgrass Prairie and VA Cemetery).

RS 1.1 Protect Human Health and the Environment:

Two commenters commented on this topic. [17.2, and 34.1] One commenter noted, "While this site must be cleaned up before the developers are allowed to proceed with their proposed intermodal transport facility, the Army has the responsibility of insuring the safety of disposal methods and environmental impact regarding both air and water quality." [17.2]

Response: *The Army has evaluated remedies and costs and intends to cleanup JOAAP in a manner that is safe, environmentally protective and cost effective prior to property transfer. The Army has the responsibility to restore the lands of JOAAP to conditions that are protective ofhuman health and the environment. Public Law 104-106 precludes transfer of contaminated sites to future users.*

RS 1.2 Concern Over Selection of Remediation Goals:

There are seven comments related to concerns over selection of remediation goals. [4.3-4.7, 7.4, 10.1, 24.2, 34.1-34.2. 1, and 34.5, 41.1, 71.5, 71.7, and 71.8] The concerns of these commenters follow:

1. John Rogner: Acting Field Supervisor; United States Department of the Interior: Fish And Wildlife Service; stated:

   "We do not believe that these PRGs for soil, sediment, and groundwater, which are based only on human health studies, are protective of the environment. More specifically, we do not believe that the PRGs are protective of the ecological assessment endpoints listed in the February 6, 1996, Department of the Army Memorandum, "Summary of the Ecological Risk Assessment Program at Joliet Army Ammunition Plant, Illinois." In general, the human health based PRGs greatly exceed toxicity reference values for soil, sediment, and water. These reference values are from site-specific toxicity tests performed at JOAAP and from other studies. The table below compares several of the PRGs with toxicity reference values. The contaminants selected for this tableare for example purposes and are not the only contaminants that exceed toxicity reference values.

Contaminant	PRG	Reference Value
2,4,6-TNT	290 mg/kg	7-19 mg/kg (lowest observed effects concentration (LOEC) plant, earthworm, bacterium)
		40-150 mg/kg (LOEC earthworms)
		5 mg/L (LOEC plant)
		30 mg/kg (LOEC plant)
Tetryl	7,400 mg/kg	25 mg/kg (LOEC plant)
Lead	1,000 mg/kg	250 mg/kg (severe effect level (SEL) sediment invertebrates)
		185 mg/kg (upland sandpiper)
Zinc	1,000,000 mg/kg	820 mg1kg (SEL sediment invertebrates)
		105 mg/kg (upland sandpipers)
Anthracene	10,000 mg/kg	370 mg/kg (SEL sediment invertebrates)
		7 mg/kg (upland sandpiper) [4.3]

"It is readily apparent from this comparison that human health basedPRGs cannot be relied upon to be protective of the environment. These PRGs, therefore, are not appropriate as remediation goals or for screening sites for no further action. [4.4]

"We suggest that remediation goals be adopted which are protective of the assessment endpoints listed in the February 6, 1996, Department of the Army Memorandum: "Summary of the Ecological Risk Assessment Program at Joliet Army Ammunition Plant, Illinois." [4.5]

"When environmental PRGs are calculated we suggest that they be submitted to the USEPA Region V Biological Technical Assistance Group (BTAG) for independent review. [4.6]

"The future use of this site for wildlife management makes it imperative that contaminants be remediated to levels which do not cause ecological harm by limiting the productivity of this area. If ecologically based PRGs are not calculated then background levels should be used as PRGs." [4.7]

Response: *In 1996, the Army, working in close coordination with USEPA and IEPA, determined that human health-based PRGs would be acceptable surrogates for ecological PRGs. This determination is documented in detail in Appendix D of the JOAAP Preliminary Remediation Goals Final Report (April 1996). This position was supported, conditionally, by USEPA and IEPA in their letter of March 1, 1996 pending the development of scientifically rigorous information.*

In developing the PRGs, the Army, USEPA and IEPA considered the environmental and ecological impacts at JOAAP. To determine the ecological impacts the Army performed a series of field investigations in order to determine actual effects on the flora and fauna of JOAAP. On the basis of those studies, the following conclusions were made:

- *The Joliet ecological system, as a whole, is outstanding, even with contamination remaining on-site. This is documented with the Survey of the Endangered and Threatened Plant and Animal Species of the JOAAP and Joliet Training Area. Will County, and with plant uptake studies as documented in Appendix D of the JOAAP PRGs Final Report, April 1996.*

- *Studies were conducted to determine and quantity the extent that explosives contamination in soils adversely affect the health of the plant and soil organisms (as determined by biomass). In these cross-correlation studies of contaminant levels and biomass, only TNT was found to have a statistically significant correlation. Even in that case, however, the differences in biomass found between the Low Effect Level (90 mg/kg) and the Potential Cleanup Goal (190 and 290 mg/kg) are statistically indeterminate. The major impact on biomass is found in moving from the high concentration of TNT (>1,000 mg/kg to PRG range.*

- *As documented in Section 5 of the February 6, 1996 memorandum, soil organisms (earthworms, microbes and plant communities) are the only sector of the ecosystem that show any impact. That impact is highly localized, considered de minimis by the Army, and expected to be addressed with remediation to the proposed levels. As USEPA, Region V noted, "although precise numbers are not available, it is evident that human health based [remedial goals] for TNT and its degradation products are well below levels that inhibit plant growth and therefore are [indirectly] protective of ecological receptors." (USEPA, Region V, Letter of 12/7/95)*

The areas where contamination is the heaviest, Manufacturing Area sites M5, M6, will be transferred to the State of Illinois foruse as an industrial park. The Army, USEPA and JEPA concur that it is not necessary or advisable to clean up to ecologically-based RGs for the areas that will be used for industrial parks or for the Will County Landfill.

Based on comments received from various organizations and individuals during the public comment period and the development of the ROD, the Army, USEPA and IEPA have agreed to select actions proposed for SRUs 1, 2, 3 and 5 for USDA soils as interim actions. Exposure levels for ecological receptors will be determined that are protective of the environment and compatible with the development of the tall grass prairie for USDA lands. A site-specific Biological Technical Assistance Group (BTAG) will be established and will advise the Army, USEPA and IEPA on this subject. Final cleanup actions will be selected in accordance with the NCP.

2. Charles Grigalauski, IEPA, commented: "Please refer to the March 1, 1996 letter from the U. S. EPA and me on the subject of preliminary remediation goals (PRGs). The position of the Agency has not changed on this matter. I support the January 13, 1998 U.S. EPA comment # 2 regarding a biomonitoring program including efforts by the Illinois Department of Natural Resources and the U.S. Forest Service." [7.4]

***Response**: The referenced letter stated,*

" We accept the use of human health based risks as a surrogatefor ecological risk-based standards with the following provisions:

That between now and the signing of the Record of Decision,

1. No data becomes available that would permit the development of scientifically rigorous ecological cleanup levels for TNT, tetryl or RDX

2. The on-going research at the Waterways Experimental Station, Argonne National Laboratory, USEPA's Environmental Research Laboratory at Athens, GA., Georgia Tech., Rice University, Louisiana State University, the University of Iowa and other research supported by the Army continues to support the efficacy of phytoremediation and produces evidence that phytoremediation by prairie grasses at levels below 290 mg/kg TNT occurs." [pg. 2]

The Army, USEPA and IEPA have agreed that a biomonitoring program is not necessary at this time since final actions for SRUs 1, 2, 3, and 5for USDA soils are not being selected at this time.

3. Rob Watson, RCRA/CERCLA Coordinator, IEPA,stated:
   The document discusses the remedial action objectives in terms of risk to human health and the environment. The RAOs must also indicate whether excavation of hazardous wastes (or soil which exhibits a characteristic of a hazardous waste) is also a remediation goal. Because the PRG concentrationsare very high relative to the TCLP limits, the Agency is concerned that a remedial action based solely on risk could leave behind soils which exhibit a characteristic of a hazardous waste. This has a direct effect on the ARARs for the remedial action.

   Specifically, if soil/waste which exhibit a characteristic of a hazardous waste, or is listed hazardous waste, will be left at the site, after the remediation is complete, the RCRA closure and post-closure requirements would be considered both relevant and appropriate and therefore ARARs.

Therefore, in order to properly evaluate the remedial alternatives and verify compliance with ARARs, the document must clearly indicate which of the following is a remedial objective:

"a. Wastes and contaminated media which exhibit a characteristic of a hazardous waste or is listed hazardous waste, will be removed or treated to non-hazardous levels or

"b. Wastes and contaminated media which exhibit a characteristic of a hazardous waste or are listed hazardous wastes will be left in place.

"Cadmium is a good example of the above concern. The risk based PRGs for cadmium are 3,000 mg/kg for an industrial scenario and 1,700 mg/kg for residential. However, the TCLP limit for cadmium is 1.0 mg/1. The preferred remedy in SRU 2: Metals in Soils, is excavation of soils with metal concentrations above the PRGs and off-site disposal. No institutional controls are identified as part of this remedy. Therefore, cleaning up to the PRGs could easily leave behind soils which exhibit a characteristic of a hazardous waste. If this occurred, the remedy would not comply with the ARARs. Examples of two LAP sites where this may occur are the soils near the popping furnaces in L2 and soils from the junkyard in L5.

"Conversely, if clean up to the PRGs will also remove soils that exhibit a characteristic of a hazardous waste, or if studies have shown that the remedy will not leave hazardous waste behind, this would be a positive addition to the description of the proposed remediation goals." [10.1]

Response: *A remedial action objective has been included in the ROD that: "Actions will not leave behind any RCRA characteristic wastes, except those contained within the capped landfills of SRU6." (see Section 6.3) To this end, the Army will conduct TCLP analyses on random confirmatory samples in accordance with the remedial design to ensure that there are no characteristic wastes remaining at each site. Specific listed wastes expected at each site are shown in the tables of Section 5 of this ROD. SRU2 characteristic wastes will be excavated and disposed at a RCRA Subtitle C landfill. SRU1 and SRU3 soils containing characteristic or listed wastes will be tested after treatment to determine if the characteristic for which they were listed is still exhibited. If so, these treated materials will be excavated and disposed at a RCRA Subtitle C landfill off-site; if not, they will be disposed at WCLF or used as backfill.*

4. Diana Mally of the USEPA requested that the Army define the performance objectives of the groundwater remedies within the ROD. [24.2]

Response: *The performance objectives for the selected groundwater remedial action (Limited Action) are to:*

(1) Achieve the groundwater cleanup to the RGs through source removal and natural attenuation.

(2) Ensure that human and animal exposure to contaminated groundwater is restricted or minimized while groundwater cleanup is occurring. [This will be done through the establishment of GMZs, deed restrictions, notifications to the future JOAAP land owners, and other institutional controls.]

(3) In cases where human or animal exposure to contaminated groundwater may occur, to ensure that appropriate steps are taken to minimize the risk to these receptors. [The Army will monitor ground and surface at agreed compliance points to ensure that contaminated water is not migrating outside of the GMZ. Landowners within the GMZ must comply with

any and all applicable laws regarding the management, discharge, disposal, or treatment of contaminated groundwater.]

5. Stephen K. Davis, Manager, Remediation Projects, Illinois Waste Management and Research Center commented on:
   - The presentation of information in the Proposed Plans concerning the determination of ecological PRGs. [34.1]
   - Whether Simini, *et al* study data was incorporated into the development of PRGs at JOAAP. [34.2]
   - Whether PRGs for TNT (190 to 290 mg/kg) are protective of ecological receptors. [Mr. Davis requested the Army provide additional justification in the Proposed Plan indicating how this protection will be accomplished. [34.2.1]
   - If ecological investigations have been conducted to determine that the proposed PRGs are protective of avian receptors, it is suggested that this information be included in the proposed plans. [34.5]

Response: *As a general note, the Proposed Plan is intended to give general and summary information of findings as a basis for presenting the recommended remedial actions. It is an explanatory document for the general public and does not provide detailed scientific data and technical discussions. Those discussions may be found in the documents held in the Administrative Record and Information Repositories. In addition, unless significant changes in data or the selected remedy occur, the Proposed Plan is not reissued for further review. The ROD and the Responsiveness Summary are the means by which specific outstanding issues are addressed.*

The final actions in this ROD which are related to land formerly used for manufacturing activities and intended for future use as industrial parks are based on human-health final RGs and not for ecological receptors (see Section 6.4)

The actions selected in this ROD for those areas to be managed for the protection and restoration of ecological resources are interim actions, which will be followed by final actions providing overall protection to human health and the environment.

1. The Restoration Advisory Board commented on the following:

   "The Soils Operable Unit proposes to treat explosives contaminated soils to levels less than the Preliminary Remedial Goals (PRGs) and rely on phytoremediation to further reduce concentrations to levels that are protective of all biological receptors. No Observable Effect Levels of explosives in soils have been observed to be lower than the PRGs for a number of species including earthworms. The RAB believes that there is a great deal of evidence that phytoremediation will reduce explosives contamination to less than 10 ppm which should protect all species but this has not been definitely demonstrated. The RAB recommends that the Army establish a monitoring program to demonstrate that this additional reduction is occurring. This program should be coordinated with the existing environmental monitoring program being operated by the Illinois Department of Conservation and the United States Forest Service." [41.1]

Response: *The Army asserts that the No Observable Effect Level is not the appropriate goal for environmental protection. The Army does agree that it would be advantageous to gain a better understanding of whether natural attenuation or biodegradation continue to degrade the explosives left on-site to levels below the RGs. Studies underway at the USEPA/Athens laboratory and the Army Corps* *of Engineers' Waterways Experimental Station are expected to demonstrate the effectiveness of degradation of residual explosives by natural attenuation. The Army is not proposing a soil monitoring plan to demonstrate natural attenuation orphytoremediation at this time.*

7. The USEPA National Remedy Review Board had the following 3 comments relative to remediation goals:
   - The Army should revise the PRGs for PCBs and lead to be consistent with USEPA guidance, future land use, and the ecological risk assessment for the site. [71.5]
   - USEPA risk assessment guidance states that if key toxicity data are not in USEPA's Integrated Risk Information System (IRIS), Regions should consult the Health Effects Assessment Summary Tables (HEAST). If this information is not in the HEAST or the documents referenced in it, Regions should consult with USEPA's Superfund Health Risk Assessment Technical Support Center in Cincinnati, OH. Since a reference dose for Tetryl (trinitrophenylmethylnitramine) is in the HEAST and hasbeen used by Regions and States at other sites, the Army should clarify its rationale for selecting a more conservative Tetryl reference dose for use at JAAP. [71.7]
   - The Board is concerned that exposure assumptions used in the Army's maintenance worker exposure scenario to calculate the PRGs for the manufacturing and load-assemble-package areas may be too conservative, given the expected future land use (Midewin National Tallgrass Prairie). [71.8]

Response:

- *The cleanup levels used for PCB spills in soils are based on USEPA's criteria under the Toxic Substances Control Act (TSCA; 40 CFR 761.120). An RG of 1 ppm will be used for all surface soils (upper 10 inches of soil).*
- *For tetryl, a toxicity value was available from HEAST. However, there was concern among the project managers that the HEAST value for tetryl was not well founded. This concern was compounded by the fact that picric acid (2,4,6-trinitrophenol, a.k.a. TNP) and/or picramic acid (2-amino-2,4-dinitrophenol; a.k.a. dinitroaminophenol; a.k.a. DNAP) are degradation products of tetryl and the Army did not have analytical data from the site on the concentrations of these two analytes. Therefore, USEPA's Superfund Technical Support Center (STSC) provided provisional RfD's for these two acids. These RfD's were derived by STSC using 2,4-dinitrophenol as a surrogate. The Army, USEPA and IEPA then decided that the lower of the PRGs established for these acids should be used for tetryl. They decided this decision because remediation of the parent compound (i.e., tetryl) to a given concentration would limit the daughter products (i.e., picric or picramic acid) to no greater than that concentration as well.*
- *The exposure scenarios are differentiated for industrial park areas and tall grass prairie areas. The industrial worker scenario is used for the industrial park areas. Less conservative park user scenarios are used for the tallgrass prairie areas.*

RS 1.3 Concerns Over Protection of the Midewin Tallgrass Prairie and the Veteran's Cemetery Parcel:

Three commenters requested that the Army take steps necessary to anticipate and provide environmental safeguards to protect the Midewin National Tallgrass Prairie, the National Veteran's Cemetery, and the environment from harm. [1.3, 5.3, and 6.3] Deed restrictions were cited as a specific environmental safeguard that could be implemented.

Response: *The Army's responsibility in this action is to clean up contamination and to transfer the property to the next landowners in a condition that is suitable for the intended future uses in accordance with Public Law 104-106. Deed restrictions will be placed on groundwater use within the groundwater management zone and on any excavating activities in the proposed capped landfills that are left in place (L3, M11 and M13). These deed restrictions are described in Section 9.2.1.2 and Appendix A. The Army is not responsible for restricting the use of the land by future landowners outside the stated deed restrictions.*

RS 2 Remediation Technology

Forty-eight comments from the 71 commenters addressed issues concerning the selection of remediation technologies. The issues were divided into six groups as follows.

RS 2.1 General Comments Supportive of the Selected Remedies:

Fifteen comments stated support for the proposed plans and the remedies recommended. [1.1, 1.2, 2.1, 5.1, 5.2, 6.1, 6.2, 7.1, 8.1, 8.6, 14.1, 15.1, 26.2, 35.1, 38.2-38.6, 39.2, 40.1.1, 42.2, and 49.1] Examples are as follows:

> "The "Proposed Plan for the Soils Operable Unit" appears to be comprehensive and based on an approach that seems reasonable andacceptable. As presented, the process that was used to evaluate each of the remedial alternatives for the cleanupof each of the Soil Remedial Units (SRUS) appears to be solidly based. It is my desire that the Army not deviate from this approach." [1.1]

> "The recommended "proposed remedial alternative" that was chosen for each SRU (Soil Remedial Unit) appears to be the best choice for remediation in each case. It is my desire that the Army will proceed to cleanup the Joliet Arsenal using recommended-remedial alternatives as presented." [1.2]

Response: *The Army has so noted.*

RS 2.2 Remedial Alternative Contingency Plans:

Eleven commenters commented on this issue. [8.5, 12.1, 12.2, 13.2, 22.3, 23&24,G2, 23.3, 29.1, 38.6, 40.2, 47.8, 50.2, 50.6, and 71.1] One commenter in two comments asked whether contingency plans were considered for the groundwater alternatives (Limited Action) and for those SRUs using bioremediation. [12.2, and 13.2] For groundwater remediation, the commenter noted:

> "In each case Alternative 2: Limited Action is the proposed action. According to this recommended action, there would be annual groundwater tests with a 5-year assessment until the PRGs are reached. It is also stated that if this Alternative (Natural attenuation) is proved ineffective the contingency plan would be implemented, i.e., the Alternative(s) to Pump and Treat. How many years will it take before it is determined to be an effective or ineffective treatment? According to the estimated time frames it may take 20 to 340 years to reach PRGs." [12.1]

For soils remediation, the commenter noted:

“We understand that bioremediation is a broad term encompassing several different methods of treatment based on site-specific needs, however, if it is determined that this treatment method is unsuccessful, based an expected time frames and results, what contingency plan would be implemented?” [13.2]

Diana Mally of the USEPA recommended that the Army provide a better discussion of the role of phytoremediation in mitigating the residual levels of explosives contamination in soils. [23&24.G2]

Response: ***Groundwater:*** *Contingency plans for the limited action alternative will be developed during the remedial design. The key parameters of that plan will be specified within the framework of the ROD. The likely time frame for making a determination on the effectiveness of natural attenuation is 10 to 15 years.*

Soils: *Bioremediation has been proven effective in cleaning up explosives-contaminated soils at other sites, including Umatilla Army Depot, where soil contamination levels and volumes were similar to those faced at JOAAP. The Army is not relying solely on these other cases to ensure the effectiveness of biroremediation. The Army is currently conducting a comparative analysis of several bioremediation processes to assist in selecting the most cost-effective and performance-effective processes. Because JOAAP soils will be used, in this study, the findings will be directly pertinent to this site. If these tests show that none of the bioremediation alternatives will treat the explosives components of the soil contamination to at or below the RGs, the Army will resort to the excavation and disposal alternative. This alternative, while less costly than bioremediation, is less desirable because it does not meet the statutory preference to permanently reduce toxicity, mobility or volume through treatment. When there are fundamental changes proposed to the ROD (e.g., from bioremediation to excavation and disposal), the Army shall prepare a ROD amendment that is subject to the public participation and documentation procedures (specified in CERCLA Section 117), and to review and approval by USEPA and IEPA.*

RS 2.3 Preference for Excavation and Disposal Alternative:

Seven commenters prefer to excavate and dispose contaminated soils rather than treatment by bioremediation. [11.2, 29.3, 32.2, 33.8.1, 50.3, 52.5, and 62.3] This change would affect the soils in SRU1 and SRU3. Another commenter suggested that excavation and disposal should be used on Site L3 (SRU6) rather than leaving contaminated soil and UXO on-site.[43.3]

Response: *The Army, in cooperation with the USEPA and IEPA, carefully considered the possibility of excavation and disposal to address soil contamination in SRU1 (explosives in soils) and SRU3 (explosives and metals in soils). Excavation and disposal would have been less expensive than bioremediation. However, excavation and disposal would not provide permanent treatment of the soils, whereas bioremediation would treat the explosives. In addition, Sites M5 and M6 of SRU3 contain RCRA hazardous wastes and could not be disposed without either treatment or delisting.*

The Army, USEPA and IEPA considered excavating and disposing the contaminated materials at Site L3, as opposed to capping the site. However, the additional environmental protection that could be gained from excavating and disposing this material was outweighed by the additional risk posed to the remediation workers at the site. The Army, therefore, recommends this site be capped.

RS 2.4 Concerns Over Dependency on the Future Proposed Will County Landfill (WCLF):

Two commenters commented on this issue. [13.1, and 18.1-18.3] One commenter asked how dependent is the success of those SRUs using excavation and disposal (SRUs 2, 3, 4, 5, 6 and 7) on the establishment of the WCLF from the standpoint of timing and costs. [13.1] The second commenter noted the need for the use of the Will County Landfill and suggested that a separate landfill in the industrial park area was not advisable.

Response: *The use of Will County Landfill for disposal of materials from JOAAP, as legislated in PL 104-106, will provide a less expensive disposal site than other landfills. Since the Army will not be assessed disposal fees, their major cost for disposal at WCLF is the cost of transportation/trucking. If, however, Will County Landfill is not available - for whatever reason - alternative disposal destinations are available off-site. The change to an alternative landfill will increase the costs to the government, but will not make the plan technically infeasible nor will require a change the selected remedies.*

RS 2.5 Concerns Over Natural Attenuation:

Nine commenters raised issues related to natural attenuation and phytoremediation. [7.2, 8.2, 22.2, 23&24.G1, 24.3-24.5, 34.4, 40.2, 41.1, and 71.1] The issues raised were:

1. That phreatic trees be used to enhance the natural attenuation of explosives in groundwater. One of the commenter recommended a fuller discussion of phytoremediation in the ROD.[22.2, 24.5, 34.4, 40.2]
2. That phytoremediation will further degrade residual explosives left in soils once RGs are met. To confirm this anticipated effect, a biomonitoring program was encouraged. [41.1]
3. That the Army use the USEPA Interim Final Rule on Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action and Underground Storage Tank Sites (OSWER Directive 9200.4-17) [7.2, 8.2, 23&24.G1]
4. USEPA requested "Specify in the ROD the criteria, or triggers, that will signal unacceptable performance of the selected remedies and indicate when to implement contingency measures. EPA believes; the triggers of unacceptable remedy performance include migration of the groundwater plumes beyond the boundaries of the established Groundwater Management Zones- (GMZs) and discharge of groundwater to surface water such that the water quality criteria for the facility prepared by the Illinois EPA in April 1997 would be exceeded." [24.3]

Response:

1. *An investigation of phytoremediation at JOAAP is being conducted by the USEPA - Athens. The Army Corps of Engineers/Waterways Experimental Station is also studying natural attenuation of explosives in groundwater at JOAAP. The results of these investigations will be used to determine the feasibility of implementation phyloremediation to enhance the biodegradation (natural attenuation) of groundwater contaminants under conditions found at JOAAP.*
2. *The Army, USEPA and IEPA will consider the value of implementing a biomonitoring plan when proposing final actions for those portions of the installation to be managed as a tallgrass prairie.*
3. *The requirements of the USEPA Interim Final Rule on Use of Monitored Natural Attenuation have been reviewed and incorporated into the ROD.*
4. *Contingency plans, covering unacceptable performance of the limited action alternatives, have been incorporated into the ROD as requested. See Section 9.2.1.6 for further detail.*

RS 2.6 Concern Regarding Issue Clarification:

Four commenters requested more information on the remedial action technology selection. [22.1, 23&24.G3, 23.5, and 23.6, 43.4, and 71.6]

1. "Considering that the contaminated percentages of soils and groundwater are about the same, why isn't the cleanup effort for the groundwater more extensive?" [22.1]
2. USEPA requested that more detail be provided on the remedy selection within the ROD [23&24.G3]
3. One commenter recommended that the Army consider containment rather than treatment of that contamination that did not pose a principal threat. [23.5]
4. One commenter noted that the text should clarify whether solidification/stabilization would be used in cases where soils fail TCLP even after treatment. [23.6]
5. One commenter was concerned over the potential for the excavation of soils to expose less fertile subsoils or to create a wetland. [43.4]
6. The USEPA National Remedy Review Board requested that the Army explain its rationale for addressing subsurface soils. [71.6]

Response:

1. *The soil cleanup costs will be much greater because a more active cleanup is proposed for the soils. The more extensive cleanup effort for soil is justified by the greater probability of exposure to contaminated soil than contaminated groundwater at the JOAAP. There are currently no human or ecological receptors of the contaminated groundwater at JOAAP - there is no pathway for exposure and no contact. The institutional controls (particularly the deed restrictions and GMZs) are intended to ensure that no pathway will be created.*
2. *More detail on the selection criteria, including the tables depicting the relative merit of each alternative by the nine CERCLA criteria, have been added to Section 9.*
3. *Explosives-contaminated soils constitute the principal threat for SRU1 and SRU3, where treatment is selected over containment options. The Army, in consultation with the Remedial Project Managers from USEPA and IEPA, decided treatment would be preferable in those cases because it provided permanent reduction of toxicity and thus removed a potential long-term liability. Containment options (excavation and on-site or off-site disposal landfills) were selected for those soils that represent low level threat wastes.*
4. *Solidification/stabilization may be used to treat those soils that fail TCLP prior to disposal in WCLF. The commenter is correct that solidification/stabilization would not be necessary for disposal of soils in a RCRA Subtitle C facility. The determination of which facility to use (WCLF or a RCRA Subtitle C landfill) will be made during the remedial design and remedial action phases.*
5. *SRU1 and SRU3 soils that come out of biotreatment and that can be used as cover or fill, will probably be used as such. The remedial design phase of action is where site restoration will be specified to ensure that the area is properly revegetated and no new unintended wetlands are produced.*
6. *No differentiation of RGs by depth was agreed upon by the Army, USEPA and IEPA. It was recognized that potential exposure will be reduced as depth increases. However, it was also noted both (a) that contaminated subsurface soils could be a continuing source of groundwater contamination, and (b) that disruption of soils andground surface levels during remedial action may bring contaminated soils to the surface at JOAAP. For thesereasons, the conservative approach of not reducing RGs with depth was accepted by the Army, USEPA and IEPA*

RS 3 Operational Issues

Twelve comments from the 71 commenters addressed issues relating to operation of the remedial actions. These comments were grouped as follows:

RS 3.1 Concerns Over RCRA Wastes:

Three commenters raised issues related to the handling of RCRA wastes. [7.3, 10.1, and 23.1] Since Bioremediation is the Proposed Alternative for several of the SRUs, the Army must determine if the treatment residuals are either listed or characteristic hazardous wastes under the Resource Conservation and Recovery Act or the Illinois Environmental Protection Act.

Response: *The Army will determine with USEPA and IEPA approval if treatment residuals of the bioremediation process are hazardous wastes under RCRA and the Illinois Environmental Protection Act. The Army has petitioned IEPA for delisting of listed wastes based on the reduction of the hazardous characteristic. Likewise, characteristic wastes will no longer be considered hazardous, once they lose their characteristics.*

RS 3.2 Concerns About Deed Restrictions:

Eight commenters expressed concerns about deed restrictions. [2.2, 5.3, 8.4, 14.3, 15.2 and 15.3, 24.4, 37.1, and 38.6). The first issue covered limitation on the use of groundwater in order to avoid migration of a contaminated plume. The second issue covered restriction on the use of the property, particularly by the industrial park developer(s). The third issue, by a single commenter, requested clarification of the role of deed restrictions in the selected remedial action for groundwater RUs. Representative statements on these issues follow:

1. "The Army Corps of Engineers/EPA must restrict activities that will affect the groundwater flow and gradients at the site. These activities would include large-scale excavation activities such as landfill excavations, quarries, etc. Smaller scale excavations such as footings for a building would not be expected to affect gradients, however, larger excavations would. By not restricting large scale excavations, the monitoring and assessment plans for the Limited Action Alternative are not systematic, well-controlled, or consistent with implementation of the natural attenuation alternative. Finally, large scale excavations have a greater chance of encountering groundwater and thus not limiting exposure to contaminants as much as possible." [2.2]
2. One commenter requested that the Army "provide environmental safeguards and impose deed restrictions as might be necessary to protect from harm the Midewin National Tallgrass Prairie, the National Veteran's Cemetery, and the environment in general." [5.3]
3. The IEPA noted that "Deed restrictions and other administrative controls will be needed to prohibit current and future landowners from using contaminated groundwater from the portions of the facility where groundwater contamination currently exists or is reasonably expected to exist in the future. These controls would remain until that point in time when Remedial Action Objectives (RAO's) for groundwater are achieved." [8.4]
4. "It would appear that any withdrawal of groundwater within the proposed Groundwater Management Zone and from the drift/dolomite would change the groundwater gradient; and therefore, the rate and direction of groundwater flow. A change in groundwater velocity or direction in this zone could disrupt the planned natural attenuation remedy. Why aren't restrictions being placed on any and all dewatering efforts in this zone? Restrictions on groundwater wells alone will not prevent other

dewatering procedures, such as the dewatering of excavations, field tile and lateral drainage systems, etc. from disrupting the gradient.” [37.1, similar comment by 38.6]

5. “We ask the Army to consider a deed restriction on the property to be conveyed to Transport Development Group. The legislation that authorizes this transfer of land includes a provision that allows the Army to place restrictions on the property to “protect the interests of the United States.” Those “interests” we urge you to consider protecting are those of our veterans and of our shared prairie heritage. The Sierra Club, along with many concerned, believes a deed restriction on the part of the Army would be appropriate action.” [14.3, 15.2 and 15.3]
6. “Identify in the ROD that the establishment GMZs or deed restrictions, will be taken as an interim action, and that the final response action will consist of periodic site inspections, groundwater and surface water monitoring, and natural attenuation.” [24.4]

Response:

1. *Deed restrictions are being negotiated between the Army and the future landowners, with the USEPA and IEPA participating to ensure that appropriate environmental safeguards are established, See ROD Sections 9.1.1.6, 9.2.1.2 and 9.3 for further detail.*
2. *See preceding response # 1.*
3. *See preceding response # 1.*
4. *The groundwater deed restrictions that are being placed in groundwater management zones are intended to restrict the movement and extraction of contaminated groundwater. The Army will monitor the location and concentrations of contaminated plumes. If actions such as large excavations do create flow of that groundwater outside of the GMZs, the Army will be responsible for implementing a suitable control or treatment program for that groundwater. Deed restrictions on groundwater use are presented in Section 9.2.1.2.*
5. *We share your concern for the proper use and environment for the Tallgrass Prairie lands and the Veterans' Cemetery. However, under this ROD, the Army can not place deed restrictions that are unrelated to its CERCLA remedial actions.*
6. *Detailed description of the selected alternatives of Limited Action for each of the GRUs is provided in Section 9.2 of the ROD. Because the GMZs and deed restrictions will be in place for the same period of time as the other components of the program (periodic site inspections, groundwater and surface water monitoring and natural attenuation), it did not seem correct to label these interim actions.*

RS 3.3 Concerns for Stormwater Runoff:

One commenter noted:

“Surface, water runoff controls will need to be in place during implementation of remedial actions. The substantive requirements of discharge criteria, for what would otherwise be required by a National Pollutant Discharge Elimination System permit, should be in the Record of Decision or not later than remedy implementation. This would apply to all contaminants of concern at the facility.” [7.8]

Response: *Section 10.2.1.1 of the ROD discusses the requirements for surface water runoff controls at the site during remedial action implementation. Section 9.1.1.4 discusses the steps that will be taken*

RS 4 Monitoring

Overall, eleven comments from the 71 commenters addressed issues related to the monitoring programs that would be implemented with the remedial actions. These comments were grouped around three issues as follows.

RS 4.1 Concerns About Groundwater Monitoring:

Five commenters commented on this issue. [8.3 and 8.7, 9.2, 24.1, 38.6, and 40.1.2]

1. "It can be assumed that a comprehensive groundwater monitoring system will be an integral part of the remedy for the Groundwater Operable Unit at the facility. Surface and groundwater sampling locations, sampling frequencies, parameters analyzed, etc., must be agreed upon during the remedial design phase of the project." [8.3]
2. "Based on recent discussions with the Army, a round of comprehensive groundwater sampling will occur in 1998 to establish a baseline of groundwater quality data. This would include inspection of monitoring wells to assure physical integrity, establishing top of casing elevations for each well, measurement of water depth from the top of casing, and sampling and analysis for agreed upon parameters based on past records." [8.7]
3. "To be in compliance with ARARS, groundwater sampling must occur at least semi-annually."[9.2]
4. "The ROD should specify that performance monitoring will be undertaken to evaluate the effectiveness of the groundwater remedies and to ensure the continued protection of human health and the environment. The ROD should state the monitoring program, to be developed during the Remedial Design, shall specify the location, frequency, and type of samples and measurements necessary to evaluate remedy performance." [24.1]
5. "I am also concerned about groundwater contaminants in Loading Area One and how they may affect Prairie Creek in the future. Will there be an ongoing monitoring program that looks at this site on a regular basis? If the contaminants (plume) are shown to be moving and could possiblyaffect Prairie Creek will the recommendation for cleanup at this site be changed?" [38.6]
6. "The RAB recommends that the monitoring program include intermediate degradation products and other measurements that can contribute to the understanding of this process in addition to the tracking of the primary contaminants." [40.1.2]

Response:

1. *Agreed. A comprehensive groundwater-monitoring plan will be developed as part of the remedial design process. See ROD Section 9.2.1.4 for further detail.*
2. *Correct. As part of the remedial design, the groundwater sampling and monitoring well inspections that are planned for 1998.*
3. *Samples from groundwater monitoring wells will be collected semi-annually. See ROD Section 9.2.1.4 for further detail.*
4. *Performance monitoring is planned. A comprehensive groundwater-monitoring plan will be developed as part of the monitoring design process and will include consideration of all parameters including location, frequency, and type of samples andmeasurements. The key parameters of that plan will be specified within the framework of the ROD.*
5. *The Army will monitor the locations of the groundwater plumes until the time when RGs are met. The migration of a GRU1 plume to Prairie Creek seems to be unlikely given the hydrogeology of the*

area and the fact that this has not happened in the 30 to 50 years to date. If however, they do migrate and surface water quality criteria are exceeded at the GMZ boundary, appropriate actions will be taken.

6. *The Army recognizes that the natural attenuation and biodegradation processes are not fully understood. A groundwater monitoring program that tracks contaminant levels (and that may in part answer these questions) will be incorporated into the Limited Action alternative.*

RS 4.2 Long-Term Monitoring:

Two commenters commented on this issue. [13.3, and 41.1]

1. One commenter stated: "Landfills; where capping is the proposed action, I anticipate the Army has a commitment to the long-term monitoring and maintenance of the sites to ensure no future problems of contamination. Please address the long-term plans for these sites." [13.3]
2. The RAB recommended that, "the Army establish a monitoring program to demonstrate that this additional reduction [from natural attenuation or phytoremediation] is occurring" [41.1)

Response:

1. *The Army will perform long term monitoring and maintenance of capped landfills as is required by RCRA.*
2. *Ongoing monitoring will be conducted on groundwater plumes (see ROD Sections 7.2.1.2, 9.2.1.4 and 9.2.1.5). This monitoring program enables the Army to analyze and evaluate the effectiveness of natural attenuation on the contaminant concentrations in groundwater. Studies of natural attenuation and/or phytoremediation have been conducted or are underway by USEPA/Athens Laboratory and by the Army Corps of Engineers/Waterways Experiment Station. At this time, the Army is not proposing additional soil quality monitoring programs to demonstrate the effectiveness of natural attenuation or phytoremediation.*

RS 4.3 Biomonitoring:

Four commenters suggested the need for a biomonitoring program, [7.4, 23.2, 34.3, and 71.4] as follows:

1. "A biomonitoring plan should be implemented as a component of the soils remedy for those areas of the facility to be managed for the protection and restoration of habitat. The monitoring program should verify that human health preliminary remedial goals will allow for the recovery of a diverse ecosystem, and should monitor the effects of the remedial actions and the potential residual risk. The-Army's biomonitoring program should be coordinated with ongoing efforts, including efforts by the Illinois Department of Conservation and the U.S. Forest Service." [23.2 & 7.4]
2. "Based on the fact that PRGs currently noted in the proposed plans were developed for JOAAP using primarily a human health risk based scenario, how does the Army intend to continue evaluating ecological risks at the site through various ecological investigations (data gathering) to ensure that the suggested remedies are protective of all Illinois trust resources? Does the Army intend to evaluate ecological exposures and the performance of the proposed remedies with regard to those ecological receptors at that mandated five-year remedy review process?" [34.3]
3. "The [NRRB] recognizes the difficulty in establishing ecological risk-based preliminary remediation goals (PRGs) for explosives at this site. Army should consider monitoring to verify that the human health PRGs used for the prairie ultimately achieve the desired ecological endpoints." [71.4]

Response:

1. *The actions selected in this ROD for those areas to be managed for the protectionand restoration of ecological resources are interim actions. The monitoring program will be considered when selecting the final remedy or these areas.*
2. *See preceding response #1*
3. *See preceding response #1.*

RS 5 Implementation

Overall, 107 comments from the 71 commenters addressed issues related to the implementation of the remedial action. These were primarily focussed on the desire to implement and complete the cleanup quickly; on the desire that local and/or union labor be used to help perform the remedial actions; on the advantage the land transfer would have for the local community tax base; and on the desire that the Army prioritize the cleanup of the industrial park areas.

The implementation issues tended to be grouped together and addressed jointly. A typical comment is:

> "As a concerned citizen of Will County, I have worked andlived around the Arsenal property for 40 years. It has been vacant for 20 years or more. It is time for the government to speed up the clean up of the Arsenal and return it to the tax roles so the people of Elwood & Wilmington can reserve tax relief for schools. It needs to be developed now. The people of Will County need the jobs now not 4 to 6 years down the line." [30.1]

Those who commented on implementation typically did not comment on other issues. However, eight expressed a preference for the selection of excavation and disposal over bioremediation -- because they believed it could be done quicker or it could create more jobs for truckers and equipment operators. [11.3, 29.2, 32.2 and 32.3, 47.2, 47.3, 47.8, 50.2 and 50.3, 52.3 and 52.5, 53.1 and 53.3, and 67.2 and 67.4] Several also expressed frustration at past problems with the JOAAP [48.4 and 48.5, 51.9, 51.10, and 51.32, and 65.2 and 65.3]

The six groups of issues concerning implementation were addressed as follows.

RS 5.1 Requests to Expedite Implementation of Remedy:

Thirty-three commenters requested that the Army move quickly to clean up the site. [3.2 and 3.3, 11.3 and 11.5, 16.4, 19.1, 21.1, 25.1, 27.1, 30.1, 31.1, 32.2, 33.8.3, 36.1, 44.1, 45.1 and 45.2, 46.1, 47.2, 50.9, 52.2, 53.1, 54.1, 55.1, 56.3, 57.1, 58.2, 59.1, 61.3, 63.3, 65.3, 66.1, 67.4, 68.2, 69.2, and 70.5] Three other commenters requested that the Army not speed up their schedule in a way that would put the basic objectives, protection of human health and the environment, at risk. [17.2, 38.3, and 42.2]

Response: *The Army shares concern of many and is working to clean up andprepare the properties for transfer as expeditiously as possible within the constraints of its legal obligations and funding. The Army must ensure that it first meets its responsibility to protect human health and the environment from the risks posed by contamination currently on-site.*

The Army estimates that the industrial park parcels that are contaminated may be transferred sooner by using bioremediation than by Excavation and Disposal. This is because of the long time if normally takes to get landfills approved, permitted, designed and operating.

RS 5.2 Request to Use Local Labor:

Twenty-three commenters requested that local labor be used in implementing the planned remedial actions. [16.2, 19.1, 27.1, 28.1, 30.1, 32.1 and 32.5, 36.1, 46.2, 47.8, 49.6, 52.5, 53.3, 54.1, 55.1, 56.2, 58.2, 60.3, 64.2, 65.2, 66.2, 67.4, 69.2, and 70.5]

Response: *With the proposed remedialion, jobs will be created for a variety of remediation workers at the JOAAP. The Army will follow proper contracting procedures and use fair labor practices in its award of contracts and subcontractors for remediation at JOAAP.*

Bioremediation will require two to three times more earth moving than simple excavation and disposal. Soils must first be moved to a treatment facility, then be moved within the facility during the treatment process, then moved to their final destination as backfill or landfill material.

RS 5.3 Request to Use Union Labor:

Eight commenters requested specifically that union labor be used in performing the remedial action at the site. [11.4, 25.1, 32.1, 36.2, 56.4, 58.2, 59.1, and 68.3] Many other implementation commenters were union members who presumably intended that their request for the use of local labor to also mean union labor.

Response: *The Army will follow proper contracting procedures and use fair labor practices in its award of contracts and subcontracts for remediation at JOAAP.*

RS 5.4 Request to Prioritizing Remediation of Industrial Park Sites.

Twelve commenters requested that the Army prioritize the cleanup of the Industrial Park areas for early transfer to the State. [3.4, 16.3, 21.1, 29.2, 31.2, 32.4, 44.1, 45.1, 47.6, 48.7-48.10, 49.4 and 49.5, and 52.4]

Response: *The Army intends to transfer 1,900 acres to the State of Illinois in 1998 for development of the Industrial Parks. The transfer of the remaining 1,200 acres to the State must await the proper cleanup of the contaminated soils found in those areas. The Army intends to transfer the Will County Landfill property in 1998. The Army has transferred approximately 15,080 acres to the USDA (Forest Service) and 980 acres to the Veterans Administration. The Army is working to ensure that these transfers be done quickly and properly.*

RS 5.5 Concerns for Improving Tax Base:

Twenty-six commenters expressed the hope that the transfer be done soon in order to improve the tax base on which community improvements will depend. [3.5, 19.1, 20.2 and20.3, 21.1, 25.1, 27.1, 28.1, 29.2, 30.1, 31.1, 32.1, 36.1, 44.1, 45.1, 46.2, 47.6, 48.7-48.10, 49.6, 53.2, 56.3, 57.1, 61.3,62.4, 63.3, 68.3, and 70.3]

<u>Response:</u> *The Army appreciates the concerns for the health and growth of the community and believes that the actions recommended will best meet these needs over the long run. The Army is planning to remediate the sites as soon as possible within budgetary and regulatory constraints to facilitate transfer of the property.*

RS 5.6 Concerns Over Remedy Implementation Schedule:

Five commenters commented on what the schedule would be for remedial action implementation. [7.5, 33.8.3, 35.2, 38.2, and 39.3] One commenter asked whether the Army intends to provide schedules within the ROD, and if not, where and when would it provide these [7.5].

<u>Response:</u> *Estimated time frames for implementation of the remedial actions will be provided within the ROD in similar detail to that provided within the Proposed Plans. The Army will submit detailed schedules for implementation of remedial actions following completion of the ROD, in accordance with the requirements of the JOAAP Federal Facility Agreement (FFA, Section XII).*

RS 6 Other Issues

Overall, twenty six comments from the 71 commenters addressed issues not covered in the general groupings discussed above. The following five sets of issues were addressed.

RS 6.1 Removal of UXOs:

Five commenters expressed concern about unexploded ordnance (UXO) remaining on-site at the JOAAP and asked what actions were planned for this UXO. [1.4, 5.4, 7.7, 14.2, and 34.6]

<u>Response:</u> *UXO is suspected or known to exist at sites L2 L3, L11, L34 and portions of L16 and L21. The UXO will be located and either removed or buried on-site under a safe protective cover. UXO removal actions are scheduled to occur during 1998 as part of a non-CERCLA project.*

RS 6.2 Sulfur Cleanup:

Three commenters raised issues relating to the cleanup of sulfur in SRU7. [7.6, 23.8, and 71.9]

1. "I support the Army efforts to address sulfur contaminated soil, which is the most likely cause of sulfate concentrations exceeding State water quality criteria in certain portions of the Manufacturing Area." [7.6]
2. "SRU7 - The CERCLA may not require taking action to address sulfur-contaminated soil, although EPA supports the Army's Plans to do so. The Army should clarify in the ROD their rationale for the planned soil removal." [23.8]
3. "CERCLA may not require the removal of sulfur-contaminated soil as a hazardous substance in Soil Remediation Unit (SRU) 7, although the Board supports the Army's plans to do so. The Army should clarify in its decision document their rationale for the planned soil removal." [71.9]

Response:

1. *The planned removal of the ash piles, as noted, should have a positive effect on the sulfate concentrations in the surface waters in contact with those piles.*
2. *SRU7 - cleanup of sulfur is being handled as a removal action outside of the remedial action process. This will be noted in the ROD, but an expanded explanation of the rationale for sulfur cleanup is provided in Section 8.2.7 of the ROD.*
3. *The Army has decided to remove the raw sulfur sites M8 and M12 for two reasons. First. raw sulfur can be toxic when ingested and should therefore be removed. Second, the raw sulfur may be a source of sulfates that have been observed downstream - removal of the raw sulfur will remove this potential contaminant source.*

RS 6.3 Concerns Over the Nature and Extent of Contamination:

Three commenters asked questions relative to the nature and extent of contamination, (23.4, 34.11, and 50.7 and 50.8) as follows.

1. " Describe in the ROD that the majority of explosive contamination in soil is found near the surface or one to two feet deep and that deeper subsurface contamination represents a small percentage of the overall volume of contaminated soil." [23.4]
2. "It should be noted that the area of concern may contain nearly 235 acres of contaminated material. Although the areal extent of the contamination may appear to be insignificant compared to the overall size of JAAP (nearly 23,000 acres), it is important to keep in perspective that even a 235-acre "Superfund" site is a very large site. The argument that only a small percentage (less than 1%) of the total acres at JAAP is actually contaminated should not be a deciding factor by which a remedy is chosen." [34.1]
3. "I'm not sure that the government, on their testing, has said exactly how much soil is there. It's an estimate, only. [50.7] What happens if the soil doubles or triples, and what will happen to the budget that's in place now. Will it expand or will it go on for more years and no development." [50.8]

Response:

1. *Site-specific descriptions of contaminants, volumes and RCRA waste classifications (if any) are given in Section 5 for each remedial unit.*
2. *The acreage of contaminated surface soils will be reduced to zero with remediation. The use of the 1% figure in the Proposed Plan was to point out that only a small total area of the JOAAP was contaminated and in need of remediation. It was not to minimize the importance of cleaning up that contamination. It also was not a deciding factor by which remedies were chosen.*
3. *The Army has sampled extensively to determine the types, locations and depths of contamination in the MFG and LAP Areas. By the very nature of sampling,there is likely to be some changes in the total contaminated volumes once actual remediation begins. The probability of these volumes doubling for the facility as a whole is extremely small. If the soil volumes increase substantially, costs will rise and remediation times may rise too. As information becomes available, the Army will modify its remedial action budget requests, if necessary, to accommodate the changes in volumes and other conditions that are encountered*

RS 6.4 Groundwater Plumes:

Two commenters asked three questions related to the groundwater plumes, [40.3 and 40.4, and 71.2] as follows.

1. “One of the plumes between study areas M6 and M8 contains perchlorethylene (PCE), a chlorinated compound known to be very persistent in groundwater, as the primary contaminant. Although PCE can be dechlorinated under certain relatively rare conditions there is no evidence that these conditions exist at JOAAP. Therefore, the only natural attenuation mechanisms to reduce concentrations are adsorption and dispersion. Although these mechanisms may eventually reduce concentrations to legal limits, they do not destroythe compound or reduce its toxicity. Furthermore, there is no proposal for source removal at this plume. Natural attenuation may be acceptable at this plume because there are no groundwater uses at risk but it is far less desirable. Alternates such as air sparging and phytoremediation are very effective at removing volatile compounds such as PCE from shallow groundwater. The RAB recommends that the Army seriously consider these alternatives for this plume during remedial design. Additional work is required to identify the source or sources of this plume and determine if LNAPLs or DNAPLs exist.” [40.3]
2. “The Central Tank Farm contains a small toluene plume. Toluene is the first of the BTEX compounds to biologically degrade in groundwater, therefore this plume should not exist after 20 years unless there is an ongoing source. The Army should look for the possible existence of LNAPLs at this plume.” [40.4]
3. “Program experience at other sites indicates that toluene tank farms are often associated with light non-aqueous phase liquid (LNAPL) ground water contamination problems. Since the JAAP has such a tank farm, the Army should ensure that their investigations have evaluated the potential for subsurface LNAPL contamination in this area. This is especially important since the Army's preferred alternative relies heavily on monitored natural attenuation to address GW contamination in this area.” [71.2]

Response:

1. *M6 and M8 PCE plumes have been considered by the Army. Past sampling data results have been inconclusive on these plumes. The current nature of this plume will be better determined with additional groundwater sampling to be conducted in 1998 during the remedial design. Should source removal and/or a treatment program be seen to be necessary, such actions will be taken.*
2. *As with the PCE plume, the current condition of the toluene plume at the Central Tank Farm will be determined in 1998 during the remedial design. It is correct that the degradation should have occurred within the 20 years since this contamination probably was released into the groundwater. During the groundwater monitoring program, the Army will sample groundwater in the area of the tank farms to determine if any free product LNAPLs remain at the site. As with the PCE, should source removal and/or a treatment program be seen to be necessary, such actions will be taken.*
3. *Toluene was detected above the RGs at two wells (MW-224 and MW-220) near the tank farms. Given that these tanks have been empty for 25 years it is not surprising that the toluene has degraded or volatilized. One well, MW-224 has shown almost a complete disappearance of toluene from a high of 20,000 µg/L (7/16/88) to a level of 1 µg/L at the most recent sampling event (1995). Further sampling of the wells will be conducted in 1998 and as part of the limited action remedy. This monitoring of the wells in this area will determine whether or not the concentrations are dropping. As part of this groundwater monitoring program, the Army will test for LNAPL free product in the area of the tank farms.*

RS 6.5 Miscellaneous Comments:

Thirteen comments were received that were not easily grouped with the sets shown above. [21.1, 32.3, 33.1.7 and 33.1.8, 34.7-34.10, 43.3, 48.2-48.6, 50.4 and 50.5, 51.2-51.32, 60.3, 62.6, 67.2 and 67.3, 70.4, and 71.3 and 71.10]

1. Hunting: "I would also like to see part of the land opened up for hunting as it was in the past." [21.1]
2. Private Sector Remediation of Site: What is "the Army's willingness to cooperate with the developers who are ready and willing to invest their dollars to provide jobs and economic development that will provide much needed tax revenue, and possibly save the taxpayers millions of dollars." [32.3], and A private contractor requested "that the Army review and respond to [its] new Alternate Soils Remediation Plan prior to the Army's final decision. By working together, we can meet the goals of the legislation for the community of Elwood, and surrounding communities, to provide the jobs and economic development consistent with that legislation." [33.1.8]
3. Use of Land after Transfer: "TDG would ... like to inform the Army that it has a Pre-Annexation Agreement, approved by the Village of Elwood, with special use permits, i.e., rock quarry, landfill, cement plant, asphalt plant and all industrial applications, including an intermodal rail facility." [33.1.7]
4. Army Role as Natural Resources Trustee: One commenter had the following comments and questions concerning the Army's role as natural resources trustee for the JOAAP property. "As the lead federal resource manager and trustee as designated under federal executive order 12580, when did the Department of Defense or the Army notify federal, state and or tribal trustees as required under 40 CFR 300.410, that there was an interest in coordinating assessments, evaluations and investigations, and engaging in planning activities at JAAP? Who at the state level was this notification sent to?" [34.7]
   "Have various natural resource trustees, such as other federal, state and tribal entities, been involved in the problem formulation phase of the ecological risk assessmentincluding various data collecting activities? It would be helpful for these groups to be identified in the proposed plans." (#34.8)
   "When was the natural resource restoration plan developed for JAAP? Will this plan be included as part of the administrative record?" [34.9]
   "If baseline conditions were evaluated prior to developing the proposed plans, how did the Army integrate 43 CFR I 1.1 4(e) as part of this review? How have the differences between remediation goals and natural resource restoration been evaluated with regard to baseline conditions and how explosive COCs may be a factor of concern?" [34.10]
5. Potential Contamination of Prairie Creek: "The materials in L3 are contributing to documented groundwater contamination in the area adjacent to the Creek, and the contaminants could end up in the Creek." [43.3]
6. Concerns Over Army Past Actions: Eight commenters expressed frustrations at past actions by the Army. As an example, one commenter noted: "I'm well-aware of the historical perspective of the Arsenal property being taken by the government and the feeling and frustration of the people of Elwood that something very valuable to them was taken withlittle or no say so on their part." [48.4]
7. Studies and Costs: "They [the Army} have literally sat at this meeting saying they have spent six years studying bugs that can correct this. Totally unacceptable. The bureaucracy of getting this done has taken years and years and years with no tax revenue to these two communities at all. They have left a big mess here." [67.2 & 67.3]

Response:

1. *Hunting: The Department of Agriculture will be the future landowner for where hunting could occur. Whether or not they allow hunting is their decision and is beyond the control of the Army. This comment is better addressed to the future landowner of the property.*
2. *Private Sector Remediation of Site: The Army is responsible for environmental clean up to a level that is protective of human health and the environment, to a level that is appropriate to the future*

intended land use and. In accordance with Federal Acquisition Regulations and contracting procedure.

3. *Use of Land After Transfer: The Pre-Annexation Agreement is outside of the scope of the Army's concerns. The use of the land, for rock quarry and other excavations, will be consistent with the limitations put within the deed restrictions.*
4. *Army Role as Natural Resources Trustee: The remediation of contamination at JOAAP is a CERCLA-based action. The actions conducted under this CERCLA program are consistent with the requirements of natural resources trustee, but they are not subject to the same procedures and policies.*
   - The actions have been conducted in cooperation with both USEPA and IEPA. Other agencies were notified of the Proposed Plans both with the legal notices placed in two local wide distribution papers, and with direct mailings (to those who have expressed an interest).
   - No natural resource restoration plan was developed for this CERCLA action, nor is one necessary.
   - No baseline conditions were developed for purposes of comparative evaluation of natural resources restoration with remediation goals.
   - The Army will support as necessary the JOAAP BTAG in its evaluation of the exposure levels of ecological resources to contaminants at JOAAP.
5. *Potential Contamination of Prairie Creek: Studies of surface water contamination have been conducted over the full course of investigations at JOAAP. Sampling and analysis data shows, no exceedances of water quality standards in Prairie Creek.*
6. *Concerns Over Past Actions: JOAAP served an essential purpose to the United States in its years of munitions production. Not all actions of its history and operations were positive to all people. The concerns of the local communities is noted. This comment is beyond the scope of this ROD.*
7. *Concern Over Study, Time and Costs: Being placed on USEPA's National Priorities List means that the Army must follow the requirements of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and means that USEPA oversees the remediation of the Army's Joliet AAP contaminated sites. Once the site was placed on the NPL the process took two directions: the Remedial Investigation (RI) and the Feasibility Study (FS). The RI Site Characterization identified what kind and how much contamination is at the site. It involved collecting and analyzing many samples to measure contaminant concentrations in soil, surface water, sediments, and groundwater for both the MFG Area and the LAP Area. This phase also included extensive field investigations to identify ways contaminants could potentially move away from the site - through surface water, groundwater, soil, or the food chain; and routes by which humans might come in contact with the contaminants - by ingestion, inhalation, or absorption through skin. These findings were used in a Risk Assessment where an evaluation of risks posed to human health and the environment by the site in its present, unremediated state was made. Depending on the results of the Risk Assessment, the Army RI/FS team, along with USEPA and IEPA had to decide that no further cleanup action is needed at the site, or site work proceeds to the next phase: developing screening, and evaluating of remedial alternatives. All the above stages have taken a long time, (17 years) and are a costly process. This was a large, complex site that required a large amount of data gathering and analysis to determine the nature and extent of contamination and the most cost effective, environmentally acceptable and safe means of cleaning up the site prior to transfer to future owners. The Army and regulators took the mandated CERCLA law approach and the most expedient effort in defining the full extent of the contamination at the site, understanding the risks posed, and determining the most appropriate means of remediation.*

[END OF SECTION]

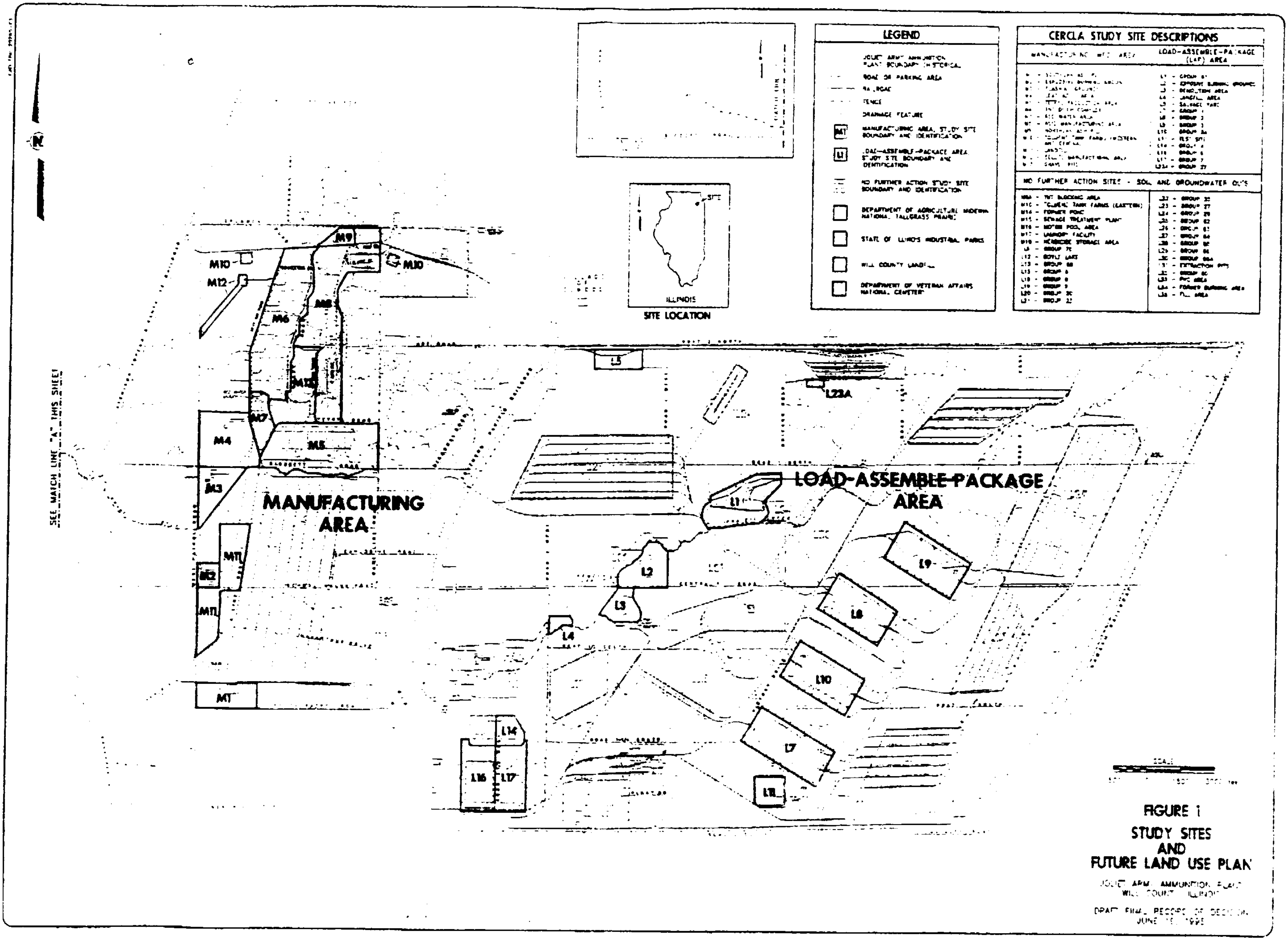
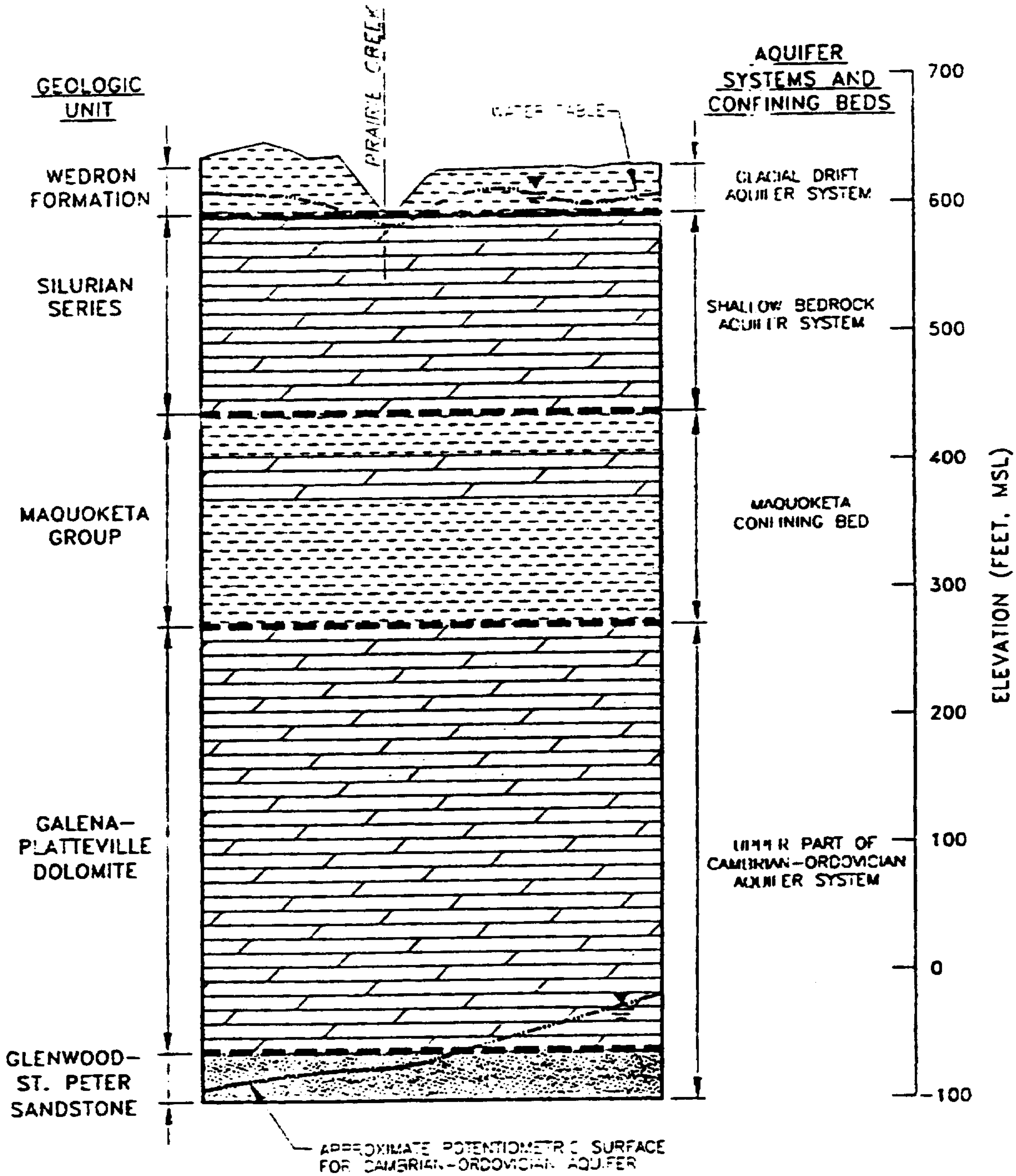


FIGURE 1
STUDY SITES AND FUTURE LAND USE PLAN
JOLIET ARMY AMMUNITION PLANT
WILL COUNTY, ILLINOIS
DRAFT FINAL RECORD OF DECISION
JUNE 15, 1995

CAD File: 20285-A1



LEGEND:

CLAY OR SHALE

SAND OR SANDSTONE

DOLOSTONE

HORIZONTAL SCALE

0 1 2 MILES

NOTE:
CROSS-SECTION PREPARED BY REFERENCE TO WELL LOGS AVAILABLE FROM THE ILLINOIS STATE WATER SURVEY, ILLINOIS STATE GEOLOGICAL SURVEY. INFORMATION CONTINUED IN VARIOUS REFERENCES AND DATA COLLECTED BY DAMES & MOORE

FIGURE 2
TYPICAL GEOLOGIC CROSS-SECTION

JOLIET ARMY AMMUNITION PLANT
WILL COUNTY, ILLINOIS

RECORD OF DECISION
SEPTEMBER 1998

Plot Scale: 1 = 1 DDD SEPTEMBER 1998

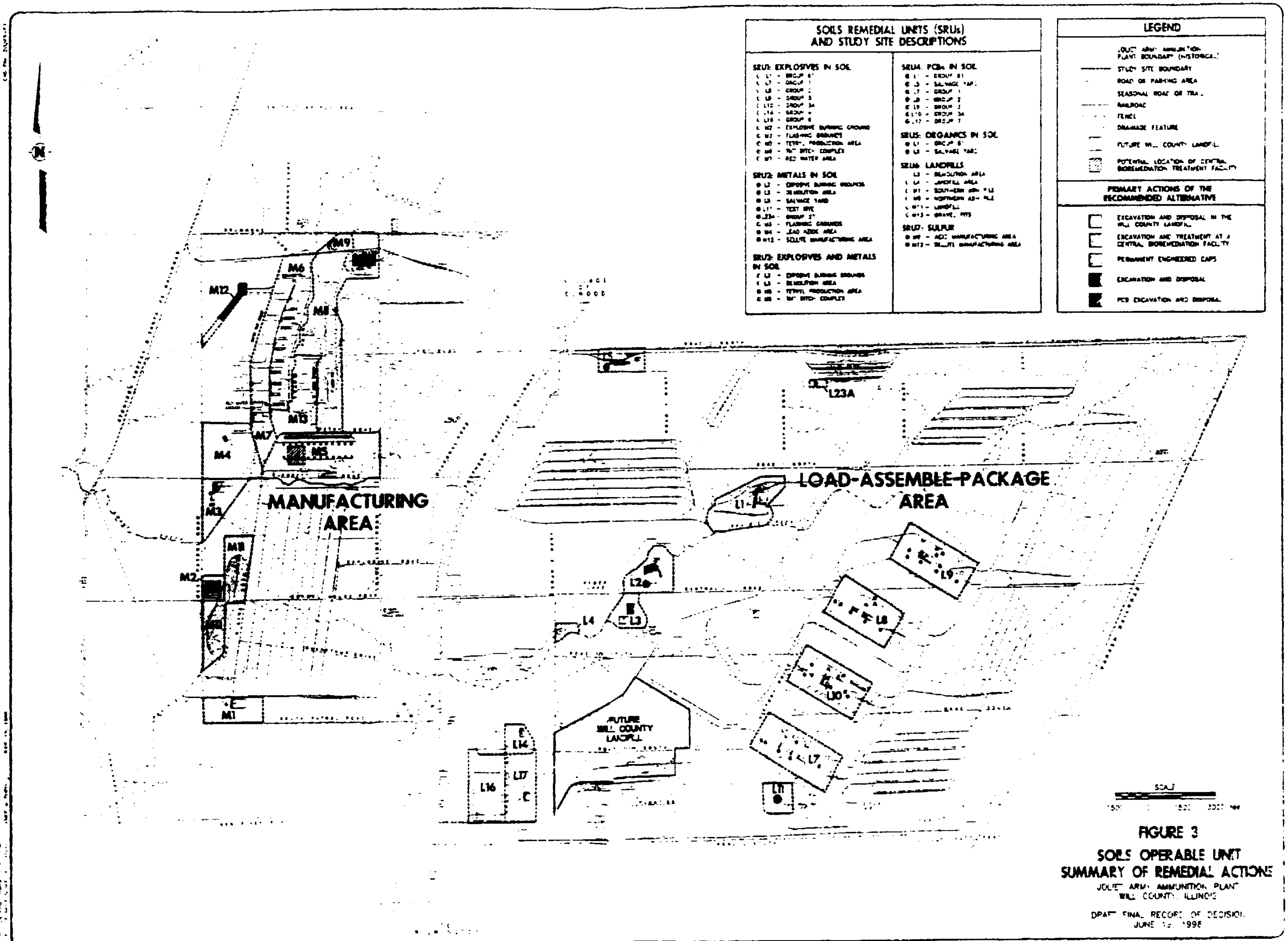


FIGURE 3

SOILS OPERABLE UNIT SUMMARY OF REMEDIAL ACTIONS

JOLIET ARMY AMMUNITION PLANT
WILL COUNTY, ILLINOIS

DRAFT FINAL RECORD OF DECISION
JUNE 1?, 1998

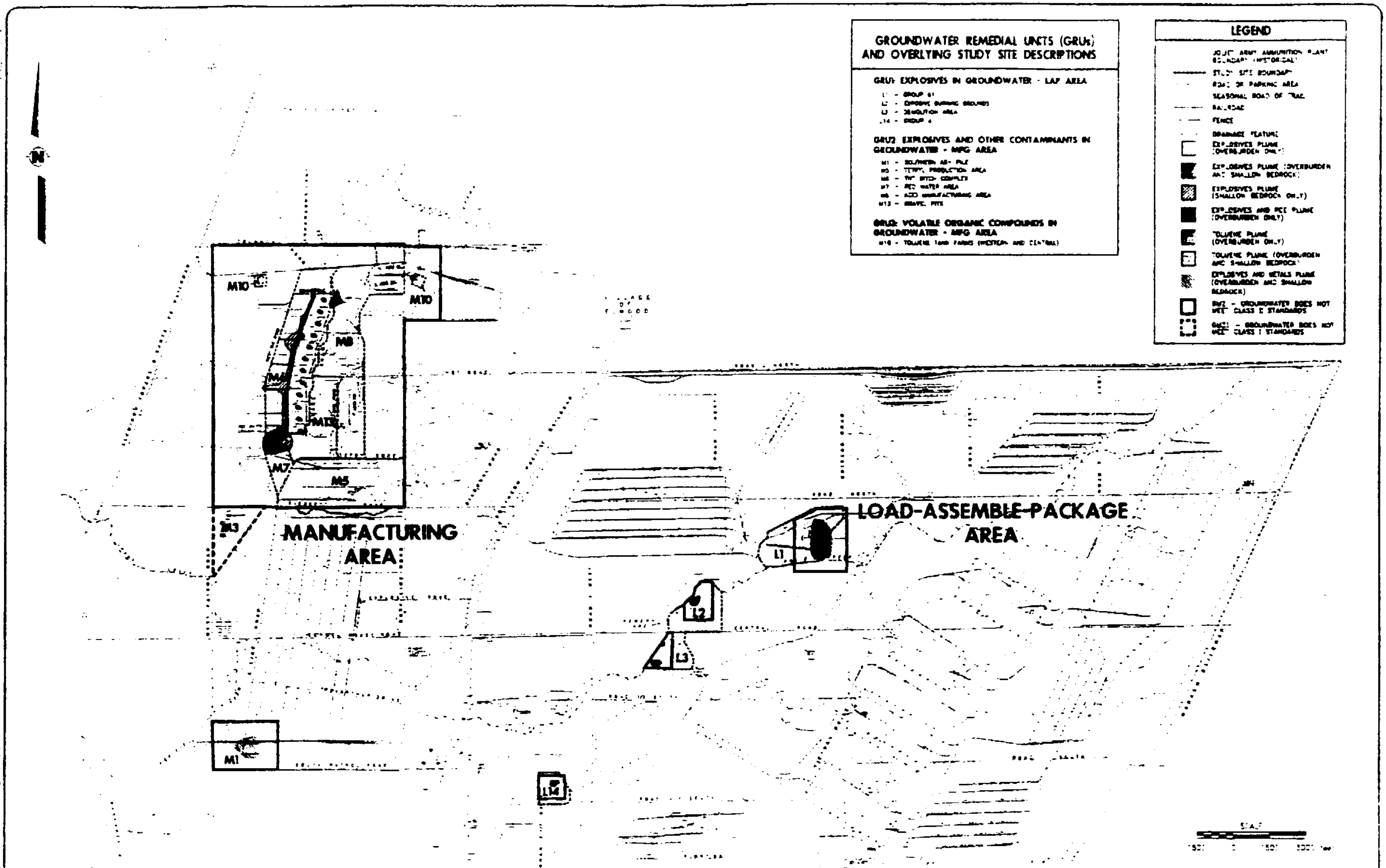


FIGURE 4

GROUNDWATER OPERABLE UNIT SUMMARY OF REMEDIAL ACTIVITIES

JOLIET ARMY AMMUNITION PLANT
WILL COUNTY, ILLINOIS

DRAFT FINAL RECORD OF DECISION
JUNE 19, 1995

APPENDIX A

Summary of RME Risk Characterization as Estimated in JOAAP Baseline Risk Assessments

SUMMARY OF RME RISK CHARACTERIZATION
AS ESTIMATED IN JOAAP BASELINE RISK ASSESSMENTS

(From BRAs conducted for MFG Area (12/94) and LAP Area (2/95))

Site	Land Use	Receptors	Media	Subarea	Pathway	Total Risk	Hazard Index
M1	Current	Maintenance Workers	Soil		a, b	5.8E-10	1.2E-04
M1			Sediment		a, b	- -	1.0E-06
M1			Surface Water		h	9.5E-09	3.5E-04
M1			Ash		a, b	1.1E-08	6.5E-05
M1		Security Worker	Soil		a, b	5.8E-11	1.2E-05
M1			Sediment		a, b	- -	1.0E-07
M1			Surface Water		h	9.5E-09	3.5E-04
M1			Ash		a, b	1.1E-09	6.5E-06
M1	Future	Maintenance Workers	Soil		a, b	1.1E-08	2.3E-03
M1			Sediment		a, b	- -	1.9E-05
M1			Ash		a, b	2.0E-07	1.2E-03
M1		Construction Worker	Soil		a, b	4.2E-09	1.0E-02
M1			Sediment		a, b	- -	9.4E-05
M1			Groundwater		d	- -	8.2E-03
M1			Ash		a, b	7.6E-08	5.8E-03
M1		Resident	Soil		a, b	6.5E-08	1.2E-02
M1			Sediment		a, b	- -	9.7E-05
M1			Groundwater		d, e, f	- -	3.1E+00
M1			Ash		a, b	1.2E-06	6.0E-03
M1		Resident (child)	Surface Water		h	1.6E-07	1.6E-02
M2	Current	Maintenance Workers	Soil		a, b	3.7E-09	7.8E-04
M2		Security Worker	Soil		a, b	3.7E-10	7.8E-05
M2	Future	Maintenance Workers	Soil		a, b	6.9E-08	1.5E-02
M2		Construction Worker	Soil		a, b	4.5E-07	2.9E-01
M2			Soil	Hotspot	a, b	2.4E-06	1.6E+00
M2			Groundwater		d	- -	- -
M2		Industrial Worker	Soil		a, b	4.6E-08	9.8E-03
M2		Resident	Soil		a, b	4.1E-07	7.3E-02
M2			Groundwater		d, e, f	- -	- -
M3	Current	Maintenance Workers	Soil		a, b, c	- -	7.4E-02
M3		Security Worker	Soil		a, b, c	- -	6.0E-02
M3	Future	Maintenance Workers	Soil		a, b, c	- -	1.5E+00
M3		Construction Worker	Soil		a, b, c	- -	2.9E+00
M3			Groundwater		d	- -	3.2E-05
M3		Industrial Worker	Soil		a, b, c	- -	1.1E+00
M3		Resident	Soil		a, b, c	- -	7.2E+00
M3			Groundwater		d, e, f	- -	2.5E-01
M4	Current	Maintenance Workers	Soil		a, b	- -	- -
M4			Soil	Hotspot	a, b	- -	- -
M4			Sediment		a, b	- -	- -
M4	Future	Security Worker	Soil		a, b	- -	- -
M4			Soil	Hotspot	a, b	- -	- -
M4			Sediment		a, b	- -	- -
M4		Maintenance Workers	Soil		a, b	- -	- -
M4			Soil	Hotspot	a, b	- -	- -
M4			Sediment		a, b	- -	- -
M4		Construction Worker	Soil		a, b	- -	- -
M4			Soil	Hotspot	a, b	- -	- -
M4			Sediment		a, b	- -	- -
M4		Industrial Worker	Soil		a, b	- -	- -
M4			Soil	Hotspot	a, b	- -	- -
M4			Sediment		a, b	- -	- -
M4		Resident	Soil		a, b	- -	- -
M4			Soil	Hotspot	a, b	- -	- -
M4			Sediment		a, b	- -	- -

SUMMARY OF RME RISK CHARACTERIZATION
AS ESTIMATED IN JOAAP BASELINE RISK ASSESSMENTS

(From BRAs conducted for MFG Area (12/94) and LAP Area (2/95))

Site	Land Use	Receptors	Media	Subarea	Pathway	Total Risk		Hazard Index
M5	Current	Maintenance Workers	Soil	EWD	a, b	2.6E-07		3.5E-01
M5			Soil	TL	a, b	1.4E-07		1.1E-02
M5			Sediment		a, b, c	2.5E-07		7.3E-05
M5		Security Worker	Soil	EWD	a, b	2.6E-08		3.5E-02
M5			Soil	TL	a, b	1.4E-08		1.1E-03
M5			Sediment		a, b, c	7.9E-09		7.3E-06
M5		Hunter	Soil	EWD	a, b	9.4E-07		1.1E+00
M5			Sediment		a, b, c	8.9E-07		2.2E-04
M5	Future	Maintenance Workers	Soil	EWD	a, b	4.9E-06		6.6E+00
M5			Soil	TL	a, b	2.6E-06		2.1E-01
M5			Sediment		a, b, c	4.6E-06		1.4E-03
M5		Industrial Worker	Soil	EWD	a, b	3.3E-06		4.4E+00
M5			Soil	TL	a, b	1.8E-06		1.4E-01
M5			Sediment		a, b, c	5.5E-06		9.1E-04
M5		Construction Worker	Soil	EWD	a, b	1.1E-06		2.0E+00
M5			Soil	TL	a, b	4.5E-06		9.5E+00
M5			Sediment		a, b, c	6.6E-07		1.2E-02
M5			Groundwater		d	9.2E-09		3.2E-03
M5		Resident	Soil	EWD	a, b	2.9E-05		3.3E+01
M5			Soil	TL	a, b	1.5E-05		1.0E+00
M5			Sediment		a, b , c	1.4E-05		6.8E-03
M5			Groundwater		d, e, f	5.3E-05		2.4E+00
M5		Resident (child)	Surface Water		h	1.7E-06		7.9E-03
M6	Current	Maintenance Workers	Soil	TNTD	a, b	4.4E-05		4.9E+00
M6			Soil	Other	a, b	1.4E-05		1.7E+00
M6			Sediment		a, b	1.3E-06	S	8.7E-02
M6					a, b	7.7E-07	T	- -
M6			Sediment	Hotspot	a, b	1.7E-06	S	2.7E-01
M6					a, b	1.6E-06	T	- -
M6		Security Worker	Soil	TNTD	a, b	4.4E-06		4.9E-01
M6			Soil	Other	a, b	1.4E-06		1.7E-01
M6			Sediment		a, b	1.3E-07	S	8.7E-03
M6					a, b	7.7E-08	T	- -
M6			Sediment	Hotspot	a, b	1.7E-07	S	2.7E-02
M6	Future	Maintenance Workers	Soil	TNTD	a, b	8.3E-04		9.3E+01
M6			Soil	Other	a, b	2.7E-04		3.2E+01
M6			Sediment		a, b	2.4E-05	S	1.6E+00
M6					a, b	1.4E-05	T	- -
M6			Sediment	Hotspot	a, b	3.2E-05	S	5.1E+00
M6					a, b	3.0E-05	T	- -
M6		Construction Worker	Soil	TNTD	a, b	3.2E-04		4.4E+02
M6			Soil	Other	a, b	6.5E-05		9.8E+01
M6			Sediment		a, b	1.0E-05	S	7.9E+00
M6					a, b	5.9E-06	T	- -
M6			Sediment	Hotspot	a, b	1.2E-05	S	2.5E+01
M6					a, b	1.1E-05	T	- -
M6			Groundwater	NP	d	2.1E-06		2.2E-01
M6			Groundwater	MP	d	1.7E-09		5.9E-05
M6			Groundwater	SP	d	9.1E-08		1.9E-04
M6		Industrial Worker	Soil	TNTD	a, b	5.4E-04		6.2E+01
M6			Soil	Other	a, b	1.8E-04		2.2E+01
M6			Sediment		a, b	1.6E-05		1.1E+00
M6					a, b	9.6E-06	T	- -
M6			Sediment	Hotspot	a, b	2.1E-05	S	3.4E+00
M6		Resident	Soil	TNTD	a, b	4.9E-03		4.6E+02

SUMMARY OF RME RISK CHARACTERIZATION
AS ESTIMATED IN JOAAP BASELINE RISK ASSESSMENTS

(From BRAs conducted for MFG Area (12/94) and LAP Area (2/95))

Site	Land Use	Receptors	Media	Subarea	Pathway	Total Risk		Hazard Index
M6			Soil	Other	a, b	1.6E-03		1.6E+02
M6			Sediment		a, b	1.1E-04	S	8.1E+00
M6					a, b	8.6E-05	T	- -
M6			Sediment	Hotspot	a, b	1.9E-04	S	2.5E+01
M6					a, b	1.8E-04	T	- -
M6			Groundwater	NP	d, e, f	1.3E-02		1.3E+02
M6			Groundwater	MP	d, e, f	9.7E-06		2.3E-02
M6			Groundwater	SP	d, e, f	5.3E-04		3.5E+00
M6		Resident (child)	Surface Water		h	6.3E-06		2.9E-01
M7	Current	Maintenance Workers	Soil	OSTA	a, b	1.4E-02		2.6E+00
M7			Soil	TNTD	a, b	1.5E-08		1.9E-03
M7			Sediment		a, b	1.7E-08		3.0E-04
M7			Surface Water	SIP	h	9.3E-06		2.2E-02
M7		Security Worker	Soil	TNTD	a, b	1.5E-09		1.9E-04
M7			Soil	OSTA	a, b	1.4E-06		2.6E-01
M7			Sediment		a, b	1.7E-09		3.0E-05
M7	Future	Maintenance Workers	Soil	TNTD	a, b	2.9E-07		3.5E-02
M7			Soil	OSTA	a, b	2.7E-04		4.8E+01
M7			Sediment		a, b	3.2E-07		5.6E-03
M7		Construction Worker	Soil	TNTD	a, b	1.5E-07		7.3E-02
M7			Soil	TNTD-Hotspots	a, b	2.5E-07		6.1E-01
M7			Soil	OSTA	a, b	7.4E-05		1.6E+02
M7			Sediment		a, b	1.2E-07		3.2E-02
M7			Groundwater		d	9.9E-09		7.8E-04
M7		Industrial Worker	Soil	TNTD	a, b	1.9E-07		2.3E-02
M7			Soil	OSTA	a, b	1.8E-04		3.2E+01
M7			Sediment		a, b	2.1E-07		3.7E-03
M7		Resident	Soil	TNTD	a, b	1.7E-06		1.8E-01
M7			Soil	OSTA	a, b	1.6E-03		2.4E+02
M7			Sediment		a, b	1.9E-06		2.8E-02
M7			Groundwater		d, e, f	5.8E-05		3.1E-01
M7		Resident (child)	Surface Water	SIP	h	3.5E-04		3.1E+00
M8	Current	Maintenance Workers Soil			a, b	- -		9.3E-04
M8			Sediment	SAD	a, b	2.3E-05	S	1.0E-03
M8					a, b	4.9E-06	T	- -
M8			Sediment	NAD/AP	a, b	- -		2.2E-02
M8			Sediment	TJC	a, b	- -		3.0E-04
M8			Surface Water	SAD	h	2.0E-08		1.1E-04
M8			Surface Water	NAD/AP	h	4.5E-09		2.3E-05
M8			Surface Water	TJC	h	- -		6.4E-07
M8		Security Worker	Soil		a, b	- -		4.9E-06
M8			Sediment	SAD	a, b	1.2E-07	S	5.4E-06
M8					a, b	2.6E-08	T	- -
M8			Sediment	NAD/AP	a, b	- -		1.2E-04
M8		Hunter	Soil		a, b	- -		1.5E-04
M8			Sediment	SAD	a, b	4.5E-06	S	1.6E-04
M8					a, b	9.4E-07	T	- -
M8			Sediment	NAD/AP	a, b	- -		3.5E-03
M8			Sediment	TJC	a, b	- -		4.8E-05
M8	Future	Maintenance Workers Soil			a, b	- -		9.3E-04
M8			Sediment	SAD	a, b	2.3E-05	S	1.0E-03
M8					a, b	4.9E-06	T	- -
M8			Sediment	NAD/AP	a, b	- -		2.2E-02
M8			Sediment	TJC	a, b	- -		3.0E-04
M8		Construction Worker	Soil		a, b	- -		8.1E-03

SUMMARY OF RME RISK CHARACTERIZATION
AS ESTIMATED IN JOAAP BASELINE RISK ASSESSMENTS

(From BRAs conducted for MFG Area (12/94) and LAP Area (2/95))

Site	Land Use	Receptors	Media	Subarea	Pathway	Total Risk		Hazard Index
M8			Sediment	SAD	a, b	1.1E-05	S	6.9E-03
M8					a, b	2.3E-06	T	- -
M8			Sediment	NAD/AP	a, b	- -		1.9E-01
M8			Sediment	TJC	a, b	- -		2.6E-03
M8			Groundwater		d	- -		2.3E-05
M8		Industrial Worker	Soil		a, b	- -		6.2E-04
M8			Sediment	SAD	a, b	1.5E-05	S	6.8E-04
M8					a, b	3.3E-06	T	- -
M8			Sediment	NAD/AP	a, b	- -		1.4E-02
M8		Resident	Soil		a, b	- -		4.6E-03
M8			Sediment	SAD	a, b	1.0E-04	S	5.1E-03
M8					a, b	2.9E-05	T	- -
M8			Sediment	NAD/AP	a, b	- -		1.1E-01
M8			Sediment	TJC	a, b	- -		1.5E-03
M8			Groundwater		d, e, f	- -		4.8E-02
M8		Resident (child)	Surface Water	SAD	h	3.4E-07		5.2E-03
M8			Surface Water	NAD/AP	h	7.5E-08		2.7E-03
M8			Surface Water	TJC	h	- -		3.0E-05
M9	Current	Maintenance Workers	Soil		a, b	- -		- -
M9			Surface Water		h	- -		5.4E-06
M9			Ash		a, b	- -		- -
M9		Security Worker	Soil		a, b	- -		- -
M9			Ash		a, b	- -		- -
M9	Future	Maintenance Workers	Soil		a, b	- -		- -
M9			Ash		a, b	- -		- -
M9		Construction Worker	Soil		a, b	- -		- -
M9			Ash		a, b	- -		- -
M9		Resident	Soil		a, b	- -		- -
M9			Ash		a, b	- -		- -
M9		Resident (child)	Surface Water		h	- -		2.5E-04
M10	Future	Construction Worker	Groundwater	WTF	d	1.2E-09		6.0E-04
M10			Groundwater	CTF	d	1.2E-10		7.5E-04
M10		Resident	Groundwater	WTF	d, e, f	1.8E-05		8.9E+00
M10			Groundwater	CTF	d, e, f	1.8E-06		1.2E+01
M11	Current	Maintenance Workers	Sediment		a, b	4.3E-11		1.5E-04
M11		Security Worker	Sediment		a, b	4.3E-12		1.5E-05
M11	Future	maintenance Workers	Sediment		a, b	8.1E-10		2.9E-03
M11					a, b	- -		- -
M11		Construction Worker	Groundwater		d	- -		6.6E-05
M11			Sediment		a, b	7.1E-07		1.4E-01
M11		Resident	Groundwater		d, e, f	- -		2.5E-02
M11			Sediment		a, b	1.5E-09		1.4E-02
M11		Resident (child)	Surface Water		h	- -		6.0E-03
M12	Current	Maintenance Workers	Soil		a, b	- -		1.1E-04
M12			Sediment		a, b	- -		9.2E-04
M12		Security Worker	Soil		a, b	- -		1.1E-05
M12			Sediment		a, b	- -		9.2E-04
M12	Future	Maintenance Workers	Soil		a, b	- -		2.0E-03
M12			Sediment		a, b	- -		1.7E-02
M12	Future	Maintenance Worker	Soil		a, b	- -		8.2E-03
M12			Sediment		a, b	- -		2.6E-01
M12			Groundwater		d	- -		- -
M12		Industrial Worker	Soil		a, b	- -		1.4E-03
M12			Sediment		a, b	- -		1.2E-02
M12		Resident	Soil		a, b	- -		1.0E-02

SUMMARY OF RME RISK CHARACTERIZATION
AS ESTIMATED IN J OAAP BASELINE RISK ASSESSMENTS

(From BRAs conducted for MFG Area (12/94) and LAP Area (2/95))

Site	Land Use	Receptors	Media	Subarea	Pathway	Total Risk		Hazard Index
M12			Sediment		a, b	- -		8.5E-02
M12			Groundwater		d, e, f	- -		- -
M12		Resident (child)	Surface Water		h	1.0E-07		3.4E-03
M13	Future		Groundwater		d	- -		5.1E-05
M13			Groundwater		d, e, f	- -		1.9E-02
M14	Current	Maintenance Workers	Soil		a, b	- -		1.6E-05
M14		Security Worker	Soil		a, b	- -		1.6E-06
M14	Future	Maintenance Workers	Soil		a, b	- -		3.1E-04
M14		Construction Worker	Soil		a, b	- -		1.4E-03
M14		Resident	Soil		a, b	- -		1.5E-03
M15	Current	Maintenance Workers	Soil		a, b	2.1E-06	S	7.9E-03
M15					a, b	8.4E-09	T	--
M15			Sediment	ND	a, b	- -		1.0E-03
M15			Sediment	SD	a, b	8.7E-06		5.7E-02
M15			Surface Water	ND	h	2.2E-09		1.4E-05
M15			Surface Water	SD	h	3.1E-09		1.1E-05
M15		Security Worker	Soil		a, b	1.1E-08		4.2E-05
M15			Sediment	ND	a, b	- -		5.5E-06
M15			Sediment	SD	a, b	4.6E-08		3.0E-04
M15	Future	Maintenance Workers	Soil		a, b	2.1E-06	S	7.9E-03
M15					a, b	8.4E-09	T	- -
M15			Sediment	ND	a, b	- -		1.0E-03
M15			Sediment	SD	a, b	8.7E-06		5.7E-02
M15		Construction Worker	Soil		a, b	9.8E-07		6.7E-02
M15			Sediment	ND	a, b	- -		7.8E-03
M15			Sediment	SD	a, b	5.0E-06		5.6E-01
M15		Industrial Worker	Soil		a, b	1.0E-06	S	5.3E-05
M15					a, b	6.0E-09	T	
M15			Sediment	ND	a, b	- -		6.9E-04
M15			Sediment	SD	a, b	5.8E-06		3.8E-02
M15		Resident	Soil		a, b	1.3E-05	S	3.9E-02
M15					a, b	5.0E-08	T	- -
M15			Sediment	ND	a, b	- -		5.1E-03
M15			Sediment	SD	a, b	5.2E-05		2.8E-01
M15		Resident (Child)	Surface Water	ND	h	8.5E-08		1.1E-03
M15			Surface Water	SD	h	1.2E-07		1.1E-03
MFG	Future	Construction Worker	Groundwater	Parcel 3	d	- -		- -
MFG		Resident	Groundwater	Parcel 3	d, e, f	- -		- -
MFG	Current	Fish consumer	Surface Water	Jackson Creek	g	6.1E-05		3.2E-01
MFG	Future	Fisherman	Surface Water	Jackson Creek	h	1.5E-07		4.1E-03
MFG		Resident (child)	Surface Water	Jackson Creek	h	5.3E-07		3.3E-03
MFG	Current	Fish Consumers	Surface Water	Grant Creek	g	6.6E-06		3.6E-02
MFG	Future	Fisherman	Surface Water	Grant Creek	h	7.9E-06		1.8E-03
MFG		Resident (child)	Surface Water	Grant Creek	h	8.3E-06		8.0E-04
L1	Current	Security Worker	Soil		a, b, c	1E-07		4E-02
L1	Future	Industrial Worker			a, b, c	1E-05		7E+00
L1		Construction Worker			a, b, c	1E-05		8E+00
L1		Resident			a, b, c	1E-04		2E+01
L1		Hunter			a, b, c	4E-06		1E+00
L1		Resident			d, e, f	4E-04		4E+02
L2	Current	Security Worker	Soil	Burning Pad	a, b, c	2E-07		2E-02
L2				Popping Furnace	a, b, c	2E-07		1E-03
L2				Oil Pits	a, b, c	3E-04		4E-02
L2		Hunter		Burning Pad	a, b, c	6E-06		6E-01
L2				Popping Furnace	a, b, c	6E-06		3E-02

SUMMARY OF RME RISK CHARACTERIZATION
AS ESTIMATED IN J OAAP BASELINE RISK ASSESSMENTS
(From BRAs conducted for MFG Area (12/94) and LAP Area (2/95))

Site	Land Use	Receptors	Media	Subarea	Pathway	Total Risk	Hazard Index
L2				Oil Pits	a, b, c	1E-02	1E+00
L2	Future	Industrial Worker		Burning Pad	a, b, c	2E-05	3E+00
L2				Popping Furnace	a, b, c	2E-05	7E-01
L2				Oil Pits	a, b, c	6E-02	5E+00
L2		Construction Worker		Burning Pad	a, b, c	2E-05	6E+00
L2				Popping Furnace	a, b, c	4E-05	1E-01
L2				Oil Pits	a, b, c	2E-03	2E+01
L2		Resident		Burning Pad	a, b, c	2E-04	2E+01
L2				Popping Furnace	a, b, c	2E-04	1E+00
L2				Oil Pits	a, b, c	2E-01	3E+01
L2		Resident	Groundwater	Burning Pad	d, e, f	8E-04	6E+00
L2				Oil Pits	d, e, f	5E-06	8E-02
L2		Resident (child)	Surface Water		h	3E-02	7E-02
L3	Current	Security Worker	Soil		a, b, c	1E-07	3E-03
L3				Northeast Area	a, b, c	8E-08	5E-03
L3				Bermed Area	a, b, c	3E-07	7E-03
L3	Future	Industrial Worker			a, b, c	2E-05	5E-01
L3				Northeast Area	a, b, c	9E-06	8E-01
L3				Bermed Area	a, b, c	4E-05	1E+00
L3		Construction Worker			a, b, c	2E-05	1E+00
L3		Resident			a, b, c	1E-04	3E+00
L3				Northeast Area	a, b, c	8E-05	5E+00
L3				Bermed Area	a, b, c	3E-04	6E+00
L3		Hunter			a, b, c	5E-06	1E-01
L3				Northeast Area	a, b, c	3E-06	2E-01
L3				Bermed Area	a, b, c	1E-05	2E-01
L3		Resident	Groundwater	Bermed Area Plume	d, e, f	1E-04	8E-01
L3				Burn Cage Plume	d, e, f	3E-05	2E-01
L4	Current	Security Worker	Soil		a, b, c	2E-08	4E-04
L4	Future	Industrial Worker			a, b, c	3E-06	8E-02
L4		Construction Worker			a, b, c	2E-06	2E-01
L4		Resident			a, b, c	2E-05	2E-01
L4		Hunter			a, b, c	7E-07	1E-02
L4		Resident	Groundwater		d, e, f	2E-05	1E-04
L5	Current	Security Worker	Soil		a, b, c	7E-04	1E-02
L5				Junk Pile	a, b, c	1E-03	3E-02
L5	Future	Industrial Worker			a, b, c	1E-01	3E+00
L5				Junk Pile	a, b, c	3E-01	6E+00
L5		Construction Worker			a, b, c	8E-03	2E+00
L5		Resident			a, b, c	3E-01	7E+00
L5				Junk Pile	a, b, c	6E-01	1E+01
L5		Hunter			a, b, c	2E-02	4E-01
L5				Junk Pile	a, b, c	5E-02	9E-01
L5		Resident	Groundwater		d, e, f	- -	3E+00
L6	Current	Security Worker	Soil		a, b, c	2E-06	2E-04
L6				PCB Spill Areas	a, b, c	2E-06	3E-04
L6	Future	Industrial Worker			a, b, c	3E-04	2E-02
L6				PCB Spill Areas	a, b, c	4E-04	3E-02
L6		Construction Worker			a, b, c	9E-05	2E-01
L6		Resident			a, b, c	1E-03	1E-01
L6				PCB Spill Areas	a, b, c	2E-03	2E-01
L6		Hunter			a, b, c	6E-05	5E-03
L6				PCB Spill Areas	a, b, c	7E-05	8E-03
L6		Resident	Groundwater		d, e, f	3E-04	1E+00
L6		Resident (child)	Surface Water		h	6E-09	8E-05

SUMMARY OF RME RISK CHARACTERIZATION
AS ESTIMATED IN J OAAP BASELINE RISK ASSESSMENTS
(From BRAs conducted for MFG Area (12/94) and LAP Area (2/95))

Site	Land Use	Receptors	Media	Subarea	Pathway	Total Risk	Hazard Index
L7	Current	Security	Soil		a, b, c	4E-06	3E-05
L7	Future	Industrial Worker			a, b, c	8E-04	3E-03
L7		Construction Worker			a, b, c	8E-05	3E-02
L7		Resident			a, b, c	2E-03	3E-02
L7		Hunter			a, b, c	1E-04	8E-04
L7		Resident	Groundwater		d, e, f	- -	1E-02
L7		Resident (child)	Surface Water		h	1E-07	3E-02
L8	Current	Security Worker	Soil		a, b, c	4E-07	4E-05
L8	Future	Industrial Worker			a, b, c	1E-04	5E-03
L8		Construction Worker			a, b, c	1E-05	1E-02
L8		Resident			a, b, c	2E-04	4E-02
L8		Hunter			a, b, c	2E-05	1E-03
L8		Resident	Groundwater		d e,f	- -	2E+00
L8		Resident (child)	Surface Water		h	7E-08	3E-02
L9	Current	Security Worker	Soil		a, b	6E-07	8E-02
L9				Bldg.3-4	a, b	1E-06	5E-02
L9				Bldg.3-5A	a, b	1E-06	3E-01
L9	Future	Industrial Worker			a, b	8E-05	9E+00
L9				Bldg.3-4	a, b	2E-04	6E+00
L9				Bldg.3-5A	a, b	2E-04	3E+01
L9		Construction Worker			a, b	2E-05	4E+01
L9		Resident			a, b	7E-04	7E+01
L9				Bld.3-4	a, b	2E-03	5E+01
L9				Bldg.3-5A	a, b	2E-03	2E+02
L9		Hunter			a, b	2E-05	2E+00
L9				Bldg.3-4	a, b	5E-05	1E+00
L9				Bldg.3-5A	a, b	5E-05	8E+00
L9		Resident (child)	Surface Water		h	3E-07	1E-01
L9		Hunter	Sediment		a, b	2E-08	3E-03
L10	Current	Security Worker	Soil		a, b, c	1E-05	2E-02
L10				Hotspot	a, b, c	4E-06	1E-01
L10		Industrial Worker			a, b, c	2E-03	2E+00
L10				Hotspot	a, b, c	5E-04	1E+01
L10	Future	Construction Worker			a, b, c	2E-04	5E+00
L10		Resident			a, b, c	6E-03	1E+01
L10				Hotspot	a, b, c	5E-03	1E+02
L10		Hunter			a, b, c	3E-04	5E-01
L10				Hotspot	a, b, c	2E-04	4E+00
L10	Groundwater	Resident			d, e, f	1E-05	9E+00
L10	Surface Wate	Resident (child)			h	2E-07	7E-03
L11	Current	Security Worker	Soil		a, b, c	7E-08	9E-04
L11	Future	Industrial Worker			a, b, c	9E-06	2E-01
L11		Construction Worker			a, b, c	1E-05	4E-01
L11		Resident			a, b, c	8E-05	5E-01
L11		Hunter			a, b, c	2E-06	3E-02
L13	Current	Security Worker	Soil		a, b	7E-10	1E-05
L13	Future	Industrial Worker			a, b	8E-08	1E-03
L13		Construction Worker			a, b	3E-08	6E-03
L13		Resident			a, b	7E-07	9E-03
L13		Hunter			a, b	2E-08	3E-04
L14	Current	Security Worker	Soil		a, b, c	1E-06	4E-02
L14				Hotspot	a, b, c	7E-06	2E-01
L14		Industrial Worker			a, b, c	1E-04	5E+00
L14				Hotspot	a, b, c	9E-04	3E+01
L14	Future	Construction Worker			a, b, c	4E-05	2E+01

SUMMARY OF RME RISK CHARACTERIZATION
AS ESTIMATED IN JOAAP BASELINE RISK ASSESSMENTS

(From BRAs conducledfor MFGArea (12194) and LAP Area (2/95))

Site	Land Use	Receptors	Media	Subarea	Pathway	Total Risk	Hazard Index
L14		Resident			a, b, c	1E-03	3E+01
L14				Hotspot	a, b, c	8E-03	2E+02
L14		Hunter			a, b, c	4E-05	1E+00
L14				Hotspot	a, b, c	3E-04	7E+00
L14		Resident	Groundwater		d, e, f	1E-03	8E+00
L14		Resident (child)	Surface Water		h	2E-08	4E-03
L15	Current	Security Worker	Soil		a, b	4E-10	4E-05
L15	Future	Industrial Worker			a, b	5E-08	5E-03
L15		Construction Worker			a, b	2E-08	2E-02
L15		Resident			a, b	4E-07	4E-02
L15		Hunter			a, b	1E-08	1E-03
L16	Current	Security Worker	Soil		a, b, c	2E-06	2E-02
L16				Hotspot	a, b, c	1E-05	9E-02
L16		Industrial Worker			a, b, c	3E-04	3E+00
L16				Hotspot	a, b, c	1E-03	1E-01
L16	Future	Construction Worker			a, b, c	9E-05	1E+01
L16		Resident			a, b, c	3E-03	2E+01
L16				Hotspot	a, b, c	1E-02	8E+01
L16		Hunter			a, b, c	8E-05	6E-01
L16				Hotspot	a, b, c	4E-04	3E+00
L16		Resident (child)	Surface Water		h	4E-08	1E-03
L17	Current	Security Worker	Soil		a, b, c	5E-06	7E-05
L17				Hotspot	a, b, c	7E-05	4E-04
L17		Industrial Worker			a, b, c	1E-03	2E-02
L17				Hotspot	a, b, c	2E-02	9E-02
L17	Future	Construction Worker			a, b, c	3E-04	3E-02
L17		Resident			a, b, c	3E-03	3E-02
L17				Hotspot	a, b, c	4E-02	1E-01
L17		Hunter			a, b, c	2E-04	2E-03
L17				Hotspot	a, b, c	3E-03	1E-02
L17		Resident (child)	Surface Water		h	- -	4E-04
L18	Future	Resident	Groundwater		d, e, f	- -	3E+00
L19	Future	Resident	Groundwater		d, e, f	- -	3E+00
L23	Current	Security Worker	Soil		a, b	4E-10	4E-03
L23	Future	Industrial Worker			a, b	9E-08	7E-01
L23		Construction Worker			a, b	5E-06	9E+00
L23		Resident			a, b	3E-07	3E+00
L23		Hunter			a, b	2E-08	1E-01
L32	Current	Security Worker	Soil		a, b	- -	2E-06
L32	Future	Industrial Worker			a, b	- -	2E-04
L32		Construction Worker			a, b	- -	1E-03
L32		Resident			a, b	- -	1E-03
L32		Hunter			a, b	- -	5E-05
L33	Current	Security Worker	Soil		a, b	2E-10	9E-06
L33	Future	Industrial Worker			a, b	2E-08	1E-03
L33		Construction Worker			a, b	1E-08	7E-03
L33		Resident			a, b	2E-07	9E-03
L33		Hunter			a, b	6E-09	3E-04
L34	Current	Security Worker	Soil		a, b	- -	2E-06
L34	Future	Industrial Worker			a, b	- -	2E-04
L34		Construction Worker			a, b	- -	2E-03
L34		Resident			a, b	- -	2E-03
L34		Hunter			a, b	- -	6E-05
SW	Current	Fisherman	Surface Water	Jordan Creek	g, h	2E-07	8E-02
SW				Prairie Creek	g, h	6E-08	7E-01

SUMMARY OF RME RISK CHARACTERIZATION
AS ESTIMATED IN JOAAP BASELINE RISK ASSESSMENTS

(From BRAs conducted for MFG Area (12/94) and LAP Area (2/95))

Site	Land Use	Receptors	Media	Subarea	Pathway	Total Risk	Hazard Index
SW				Kemery Lake	g, h	2E-05	6E-01
SW		Consumer of Fish		Jordan Creek	i	5E-07	1E-01
SW				Prairie Creek	i	2E-07	2E+00
SW				Kemery Lake	i	3E-04	2E+00
SW	Future	Resident (child)		Jordan Creek	g, h	9E-08	1E-01
SW				Prairie Creek	g, h	2E-08	9E-01
SW				Kemery Lake	g, h	6E-06	8E-01

NOTES: Scenarios and risk calculations are as they were estimated in Baseline Risk Assessments of 1994 (MFG Area) and 1995 (LAP Area).

KEY:

Exposure Pathways

a	ingestion of soil
b	Inhalation of soil as dust
c	Dermal absorption of contaminants in soil
d	Ingestion of groundwater
e	Inhalation of volatiles emitted from groundwater during showering
f	Dermal absorption of contaminants in groundwater during showering
g	Ingestion of surface water
h	Dermal absorption of contaminants in surface water
i	Consumption of fish that have bioconcentrated contaminants from surface water

Subareas

blank	Blank locations in "SUBAREA" column refer to the entire site.
CTF	Central Tank Farm (M10)
EWD	East-West Ditch (M5)
UP	Middle Plume (M8)
NAD/AP	Northern Acid Ditch and Acid Ponds (M8)
ND	North Ditch (M15)
NP	Mortern Plume (M8)
OSTA	Open Storage Tank M(M7)
Other	Areas other than TNT Ditch (M6)
SAD	Southern Acid Ditch (M8)
SD	South Ditch (M15)
SIP	Small Intermittent Pond (M7)
SP	Southern Plume (M8)
TJC	Tributaries to Jackson Creek (M8)
TL	Tetryl Line (M5)
TNTD	TNT Ditch (M6 and M7)
WTF	Western Tank Farm (M10)

Risk Calculation (*last three columns)*

- -	denotes that either a slope factor or RfD is not available.
S	The oral and inhalation slope factors for benzo(a)pyrene are used as surrogates for all B2 PAHs.
T	The toxic equivalent factors were applied to B2 PAHs to develop individual slope factors relative to benzo(a)pyrene because the surrogate approach resulted in risks between 1E - 03 and 1E-06

APPENDIX B

Summary of Estimated Costs of Remedial Alternatives for All SRUs and GRUs

<u>Summary of Estimated Costs of Remedial Alternatives for All SRUs and GRUs</u>

Remedial Unit and Sites	Selected Alternative?	Alternative	JOAAP Area/ Specific Sites	Volume (CY or MG)	Total Costs (NPV)	Years (2)	Component Costs (in current year value): Capital	Annual O&M	Site Closeout
SRU1: Explosives		2: Institutional Controls	All SRU1	151,480	$ 3,000,000	30	$ 1,500,000	$ 130,000	$$ 20,000
L1, L7, L8, L9, L10,	**Yes**	**3: Bioremediation**	**All SRU1**	**151,480**	**$ 39,300,000**	**3**	**$ 13,800,000**	**$ 9,400,000**	**$ 900,000**
L14, L16, M2, M3,		4: On-site Incineration	All SRU1	151,480	$ 76,600,000	2	$ 10,000,000	$ 34,800,000	$ 4,100,000
M5, M6, M7		5: Excavation and Disposal	All SRU1	151,480	$ 23,100,000	1	$ 23,100,000	$ -	-
SRU2: Metals		2: Institutional Controls	All SRU2	22,940	$ 300,000	30	$ 200,000	$ 10,000	$ 2,000
L2, L3, L5, L11,		3: Stabilization/Solidification	All SRU2	22,940	$ 6,700,000	1	$ 6,700,000	$ -	$ -
L23A, M3, M4, M12	**Yes**	**4: Excavation and Disposal**	**All SRU2**	**22,940**	**$ 4,000,000**	**1**	**$ 4,000,000**	**$ -**	**$ -**
SRU3: Explosives and Metals		2: Institutional Controls	All SRU3	30,920	$ 30,000	30	$ 100,000	$ 10,000	$ 2,000
	Yes	**3: Bioremediation**	**MFG SRU3 only**	**13,500**	$ 4,000,000	3	$ 1,300,000	$ 1,000,000	$ 96,000
		4: On-Site Incineration	All SRU3	30,920	$ 15,800,000	2	$ 2,000,000	$ 7,200,000	$ 870,000
L2, L3, M5, M6	**Yes**	**5: Excavation and Disposal**	**LAP SRU3 only**	**17,420**	$ 2,800,000	1	$ 2,800,000	$ -	$ -
SRU4: PCBs		2: Institutional Controls	All SRU4	3,416	$ 8,000	30	$	$ 2,000	$ -
		3: Chemical Dehalogenation	All SRU4	3,416	$ 4,100,000	1	$ 5,000	$ -	$ -
		4: Low Temperature Thermal					4,100,000		
L1, L5, L7, L8, L9,		Desorption	All SRU4	3,416	$ 2,400,000	1	$	$ -	$ -
L10,		**5: Excavtion/Incineration and**					2,4000,000		
L17	**Yes**	**Disposal**	**All SRU4**	**3,416**	**$ 1,400,000**	**1**	**$ 1,400,000**	$ -	$ -
SRU5: Organics		2: Institutional Controls	All SRU5	2,410	$ 100,000	30	$ 100,000	$ 300	$ -
		3: Bioremediation	All SRU5	2,410	$ 2,200,000	1	$ 2,200,000	$ -	$ -
		4: Solvent Extraction	L5 Drainage	555	$ 1,300,000	1	$ 1,300,000	$ -	$ -
L1, L5		5: Low Temperature Thermal	Ditch						
		Desorption		2,410	$ 1,800,000	1	$ 1,800,000	$ -	$ -
		6: Excavation and Disposal	All SRU5	**2,410**	**$ 300,000**	**1**	**$ 300,000**	$ -	$ -
	Yes		**All SRU5**						
SRU6: Landfills		2: Institutional Controls	All SRU6	689,800	$ 3,000,000	30	$ 800,000	$ 180,000	$ 48,000
	Yes	**3: Capping**	**LAP - L3**	35,000	$ 500,000	30	$ 600,000	$ 3,000	$ -
	Yes	**3: Capping**	**MFG - M11**	66,600	$ 16,600,000	30	$ 14,200,000	$ 186,000	$ 71,000
	Yes	**3: Capping**	**MFG - M13**	222,000	$ 23,800,000	30	$ 2,400,000	$ 31,000	$ 12,000
L3, L4, M1, M9, M11,	**Yes**	**4: Excavation and Disposal**	**LAP - L4**	37,000	$ 1,200,000	1	$,1200,000	$ -	$ -
M13	**Yes**	**4: Excavation and Disposal**	**MGF - M1**	205,200	$ 6,800,000	1	$ 6,800,000	$ -	$ -
	<u>Yes</u>	**<u>4: Excavation and Disposal</u>**	**<u>MFG -M 9</u>**	<u>124,000</u>	$ <u>4,100,000</u>	<u>1</u>	<u>$ 4,100,000</u>	<u>$ -</u>	<u>$ -</u>
	Yes	**Subtotal for Landfill Remedies**	**All SRU6**	**689,800**	**$ 32,000,000**	**1/30**	**$ 29,000,000**	**$ 200,000**	**$ 100,000**
SRU7: Sulfur		2: Institutional Controls	All SRU7	7,500	$ 100,000	30	$ 100,000	$ 300	$ -
M8, M12	**Yes**	**3: Remove/Recycle/Disposal**	**All SRU7**	**7,500**	**$ 200,000**	**1**	**$ 200,000**	$ -	$ -

Summary of Estimated Costs of Remedial Alternatives for All SRUs and GRUs(cont.)

Remedial Unit and Sites	Selected Alternative?	Alternative	JOAAP Area/ Specific Sites	Volume (CYorMG)	Total Costs (NPV)	Years(2)	Component Costs (*in current year value*) Capital	Annual O & M	Site Closeout
GRU1: Explosives — LAP Area	**Yes**	**2: Limited Action**	**All GRU1**	87	$ 530,000	30	$ 50,000	$ 40,000	$ -
L1,L2,L3,L14		3: Pump and Treat with Carbon Adsorption	All GRU1	87	$ 3,800,000	30	$ 1,100,000	$ 300,000	$ -
GRU2: Explosive and Other Contaminants - MFG Area	**Yes**	**2: Limited Action**	**All GRU2**	**542**	**$ 3,300,00**	**30**	**$ 900,000**	**$ 190,000**	**$ 14,000**
M1,M5,M6, M7,M8, M13		3: Pump and Treat with Bioreactor	All GRU2	542	$ 13,700,000	30	$ 8,100,000	$ 400,000	$ -
		4: Pump and Treat with Carbon Adsorption	All GRU2	542	$ 16,500,000	30	$ 5,500,000	$ 700,000	$ -
		5: Pump and Treat with UV Oxidation / Carbon Adsorption	All GRU2	542	$ 16,400,000	30	$ 7,800,000	$ 700,000	$ -
GRU3: Volatile Organic Compounds - MFG Area	**Yes**	**2: Limited Action**	**All GRU3**	**3**	**$ 700,000**	**30**	**$ 70,000**	**$ 50,000**	**$ 30,000**
M3, M10 (Western and Central Tank Farms)		3: In-Situ Bioremediation	All GRU3	3	$ 2,100,000	8	$ 1,100,000	$ 200,000	$ 100,000
		4: Pump and Treat with Air Stripping/Vapor Phase	All GRU3	3	$ 2,100,000	8	$ 1,400,000	$ 100,000	$ $ 100,000
		5: Pump and Treat with Carbon Adsorption	All GRU3	3	$ 2,100.000	8	$ 1,400,000	$ 100,000	100,000
		6: Pump and Treat with UV Oxidation/Carbon Adsorption	All GRU3	3	$ 2,400,000	8	$ 1,600,000	$ 100,000	100,000
Total GRUs		Selected Remedial Alternatives	SRUs	908,466 CY	$ 84,000,000		$ 53,000,000	$ 11,000,000	
Total GRUs		Selected Remedial Alternatives	GRUs	632 MG	$ 4,530,000		$ 1,020,000	$ 280,000	See Note (3)
Grand Total		Selected Remedial Alternatives	SRUs and GRUs		$ 88,530,000		$ 54,020,000	$ 11,280,0001	

Notes: (1) Selected remedial alternatives are highlighted in **bold font.**

(2) Years show the estimated time to complete from the first year of implementation through completion of operations and maintenance. Maximum of 30 years is shown for purpose of the economic analysis presented in table. Time to reach RGs may exceed the 30 years shown.

(3) Summary of component costs is appropriate only if all have been discounted to same year values (such as present year values).